


TECHNICAL DATASHEET #TDAX130500  
**DUAL UNIVERSAL SIGNAL CONVERTER**  
2 Analog, Resistive, Digital or PWM Signal Inputs  
2 Analog or Digital Signal Outputs  
Output and CAN Isolation  
12 Vdc, 24 Vdc  
CAN (SAE J1939)  
with Electronic Assistant® 

P/N: AX130500

**Description:**

The dual universal signal converter accepts two voltage, current, resistive, frequency, RPM, PWM or digital control signal inputs and converts them into two signal outputs (analog voltage, analog current or digital signal). The control can be networked to a SAE J1939 networked engine control system. The outputs are isolated from the inputs. The CAN bus port is isolated from both inputs and outputs.



Using the Electronic Assistant® programming tool, the user can select the desired inputs from the following signal options.

- 0-1 V, 0-2.5 V, 0-5 V, 0-10 Vdc
- 4-20 mA, 0-20 mA, 0-200 mA
- 30 Ohms to 250 kOhms
- Frequency/RPM
- PWM
- or Digital (Active High or Active Low).

The outputs can also be programmed as 0-5 Vdc, 0-10 Vdc, 0-20 mA, 4-20 mA, Frequency, RPM, PWM or digital on/off signals.

A rugged power supply interface accepts 12 Vdc or 24 Vdc nominal for battery powered machine applications. The unit carries an IP67 rating. The rugged aluminum enclosure with 12 pin Deutsch IPD connector is suitable for diesel engine environments. It operates from -40 to 85°C (-40 to 185°F).

**Applications:**

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

**Ordering Part Numbers:**

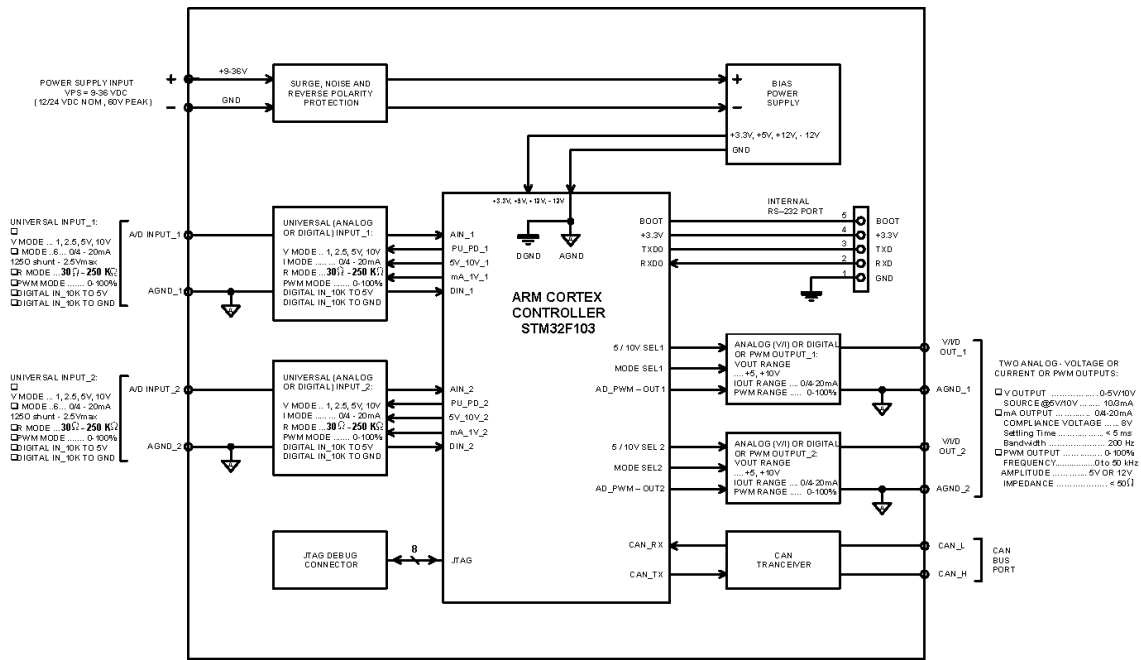
Universal Dual Signal Converter, SAE J1939, with Isolation: **AX130500**

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

Electronic Assistant®: **AX070502**

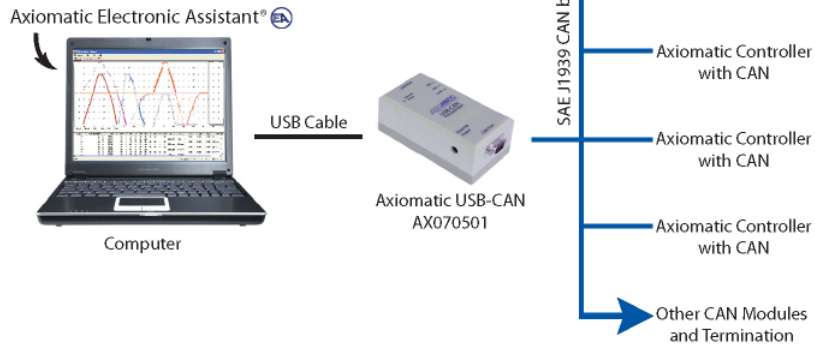
# Technical Specifications:

## Block Diagram



## User Interface

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.

## Inputs

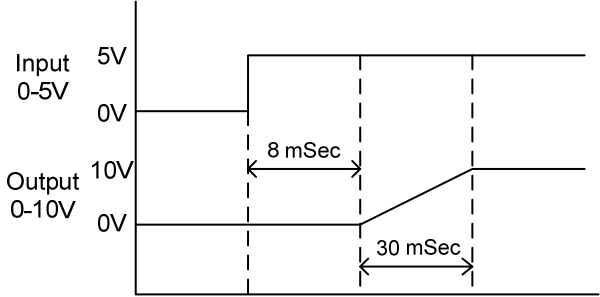
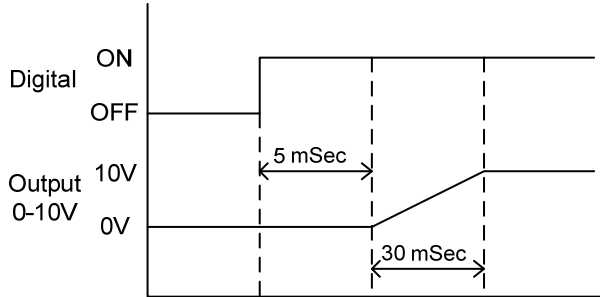
Power Supply Input	12 Vdc or 24 Vdc nominal (9...36 Vdc power supply range) Shutdown voltage is 8.22 Vdc.																																								
Protection	Reverse polarity protection Overvoltage protection is up to 60 V.																																								
Inputs	2 Universal Signal Inputs User programmable as Voltage, Current, Resistive, Frequency, RPM, PWM or Digital signal inputs. Refer to Table 1.0. Inputs and Power are isolated from the outputs and CAN.																																								
Input Grounds	1 provided																																								
<b>Table 1.0 – Inputs – User Programmable Options</b>																																									
Analog Input Functions	Voltage Input, Current Input or Resistive Input																																								
Voltage Input	0-1 V (Impedance 1 MOhm) 0-2.5 V (Impedance 1 MOhm) 0-5 V (Impedance 200 KOhm) 0-10 V (Impedance 150 KOhm)																																								
Current Input	0-200 mA (Impedance 5 Ohm); 1V max. 0-20 mA (Impedance 125 Ohm) 4-20 mA (Impedance 125 Ohm) 125 Ohm shunt – 2.5V max.																																								
Resistive	30 Ohms to 250 kOhms																																								
Digital Input Functions	Discrete Input, PWM Input, Frequency Input																																								
Digital Input Level	5 V TTL Threshold: Low <1.5 V High >3.5V																																								
PWM Input	0 to 100% 100 Hz to 10 kHz																																								
Frequency/RPM Input	0.5 Hz to 50 Hz; 10 Hz to 1 kHz; or 100 Hz to 10 kHz																																								
Digital Input	Active High or Active Low with 10 kOhm pull-up or pull-down																																								
Maximum and Minimum Ratings	<table border="1"> <thead> <tr> <th>Characteristic</th> <th>Min</th> <th>Max</th> <th>Units</th> </tr> </thead> <tbody> <tr> <td>Power Supply</td> <td>9</td> <td>36</td> <td>V dc</td> </tr> <tr> <td>Voltage Input</td> <td>0</td> <td>12</td> <td>V dc</td> </tr> <tr> <td>Current Input</td> <td>0</td> <td>200</td> <td>mA</td> </tr> <tr> <td>Resistive Input</td> <td>30</td> <td>250 000</td> <td>Ohms</td> </tr> <tr> <td>Digital Input</td> <td>Active High</td> <td>Active Low</td> <td></td> </tr> <tr> <td>PWM Duty Cycle</td> <td>0</td> <td>100</td> <td>%</td> </tr> <tr> <td>PWM Frequency</td> <td>100</td> <td>10 000</td> <td>Hz</td> </tr> <tr> <td>PWM Voltage pk - pk</td> <td>0</td> <td>12</td> <td>V dc</td> </tr> <tr> <td>RPM Frequency</td> <td>0.5</td> <td>10 000</td> <td>Hz</td> </tr> </tbody> </table>	Characteristic	Min	Max	Units	Power Supply	9	36	V dc	Voltage Input	0	12	V dc	Current Input	0	200	mA	Resistive Input	30	250 000	Ohms	Digital Input	Active High	Active Low		PWM Duty Cycle	0	100	%	PWM Frequency	100	10 000	Hz	PWM Voltage pk - pk	0	12	V dc	RPM Frequency	0.5	10 000	Hz
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## Outputs

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Isolation	<p>300 Vrms The outputs are isolated from the inputs. The CAN bus port is isolated from both inputs and outputs.</p>																										
Protection for Output Terminals	<p>Fully protected against short circuit to output ground. Unit will fail safe in the case of a short circuit condition, self-recovering when the short is removed.</p>																										

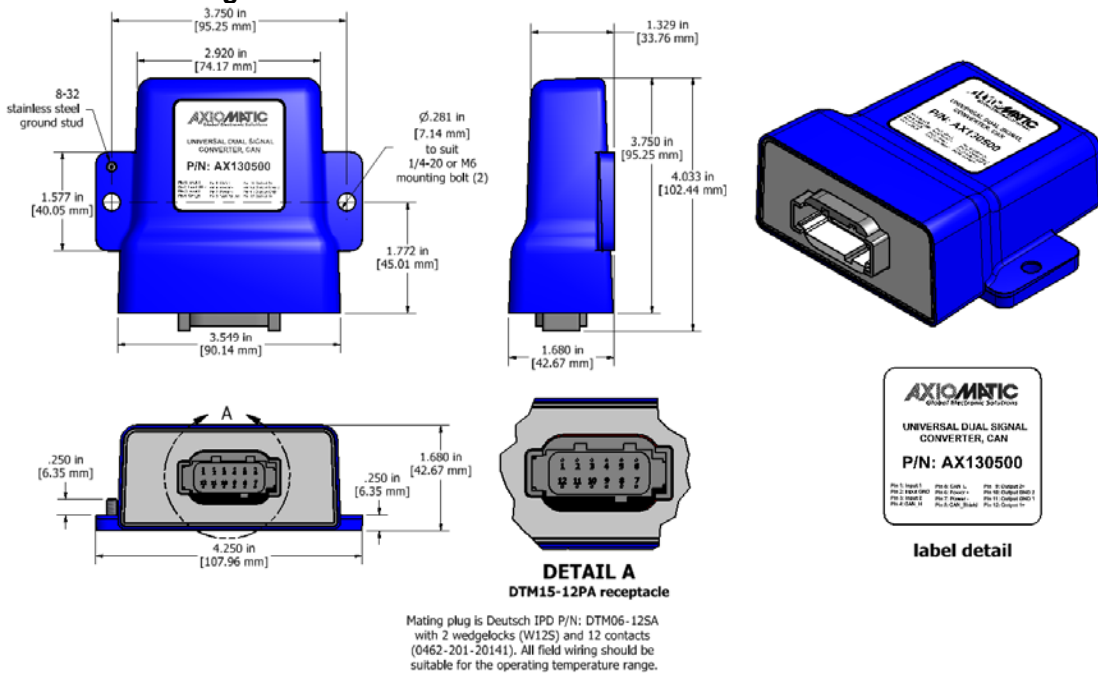
## General Specifications

Microprocessor	STM32F103 32-bit, 512 kByte flash memory
Typical Quiescent Current	0.11A @ 12 Vdc; 0.05A @ 24 Vdc

Response Time	<div style="text-align: center;"> <h3>Analog Input Response Time</h3>  </div> <p><b>Figure 1 Analog input response time</b></p> <div style="text-align: center;"> <h3>Digital Input Response Time</h3>  </div> <p><b>Figure 2 Digital input response time</b></p>
Control Logic	Standard embedded software is provided. <i>(Application-specific control logic or factory programmed set point file on request)</i>
Communications	1 Isolated CAN port (SAE J1939) (CANopen® on request)
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	<p>The AX130500 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 <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 AX130500.</p> <p>The Electronic Assistant®, P/N: <b>AX070502</b>, for <i>Windows</i> 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 <i>Windows</i>-based PC.</p>
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Storage Temperature	-55 to 125 °C (-67 to 257°F)
Protection	IP67
Weight	0.65 lbs. (0.30 kg)
Packaging	Aluminum enclosure, integral Deutsch IPD connector P/N: DTM15-12PA 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	<p>For mounting information, refer to the dimensional drawing.</p> <p>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. 16AWG or 22AWG wiring is recommended for this connector. 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. 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.</p>
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**Dimensional Drawing**



Electrical Connections	<p>12 pin Deutsch IPD connector P/N: DTM15-12PA  Mates with: Mating plug KIT: Available from Axiomatic as p/n: <b>PL-DTM06-12SA</b>.  It is comprised of the following Deutsch IPD parts: plug (DTM06-12SA); wedgelock (WM12S); 12 contacts (0462-201-20141); and 6 sealing plugs (0413-204-2005).</p> <table border="1"> <thead> <tr> <th>Pin #</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>1</td><td>Analog/Digital Input 1</td></tr> <tr><td>2</td><td>Input GND</td></tr> <tr><td>3</td><td>Analog/Digital Input 2</td></tr> <tr><td>4</td><td>CAN_H</td></tr> <tr><td>5</td><td>CAN_L</td></tr> <tr><td>6</td><td>Power +</td></tr> <tr><td>7</td><td>Power -</td></tr> <tr><td>8</td><td>CAN_Shield</td></tr> <tr><td>9</td><td>Analog/Digital Output 2+</td></tr> <tr><td>10</td><td>Output GND 2</td></tr> <tr><td>11</td><td>Output GND 1</td></tr> <tr><td>12</td><td>Analog/Digital Output 1+</td></tr> </tbody> </table>	Pin #	Description	1	Analog/Digital Input 1	2	Input GND	3	Analog/Digital Input 2	4	CAN_H	5	CAN_L	6	Power +	7	Power -	8	CAN_Shield	9	Analog/Digital Output 2+	10	Output GND 2	11	Output GND 1	12	Analog/Digital Output 1+
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## Control Logic

From the software prospective, the AX130500 consists of a set of internal functional blocks, which can be individually programmed and arbitrarily connected together to achieve the required system functionality.

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

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 cannot 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®.

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](http://www.axiomatic.com/service.html).*

Form: TDAX130500-01/02/14