

## 16 Analog I/O Module

8 analog inputs, 8 +5V


8 analog outputs

CAN (SAE J1939)

P/N: AX030200

with Electronic Assistant® 

### Features:

- 8 inputs are user selectable from the following.
  - 0-5V, 0-10V, 4-20 mA or 0-20 mA
  - Digital inputs for interface to switches, etc.
  - PWM signal, pulse or 16-bit counter inputs from sensors or diesel engine ECM's
  - Enable or disable input commands
- 8 voltage reference outputs power external sensors
- 8 analog outputs (0-5V, 0-10V, +/-5V, +/-10V, 0-20 mA, 4-20 mA)
- 12/24VDC input power (nominal)
- 1 CAN (SAE J1939), 1 RS-232
- CANopen® module available on request (P/N: AX030201)
- Rugged IP67 packaging and connectors
- **Electronic Assistant®**  runs on a Windows operating system for user configuration, saving and writing settings to additional controllers during set-up. An Axiomatic USB-CAN converter links the PC to the CAN bus.



**Description:** The controller features 1 CAN port for user-defined communications over the bus. It accepts up to 8 analog inputs (0-5V, 0-10V, 0-20 mA or 4-20 mA). Voltage references are provided to power external sensors. The user can alternatively select PWM inputs. Each can be configured to measure the input value, and send the data to a SAE J1939 CAN network. The I/O module provides 8 analog outputs (0-5V, 0-10V, +/-5V, +/-10V, 0-20 mA, 4-20 mA). Diagnostics messages are provided over the CAN network for the status of inputs or outputs. A RS-232 port is provided for user configuration via PC or for diagnostic purposes. Rugged IP67 rated packaging in addition to a 12 or 24V power supply input section suits power generation and large engine applications. During set-up, using an USB-CAN converter and a PC, the operator can configure the controller via the Electronic Assistant® to suit a variety of applications.

### Applications:

- Power generation, Cogeneration, Stationary power
- Large engines

### Ordering Part Numbers:

SAE J1939 version

Controller: **AX030200**

If the standard software or setpoint files are not suitable for your application, contact Axiomatic.

Accessories:

Mating plug kit **AX070200** (8-pin and 40-pin, no key)

**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.**

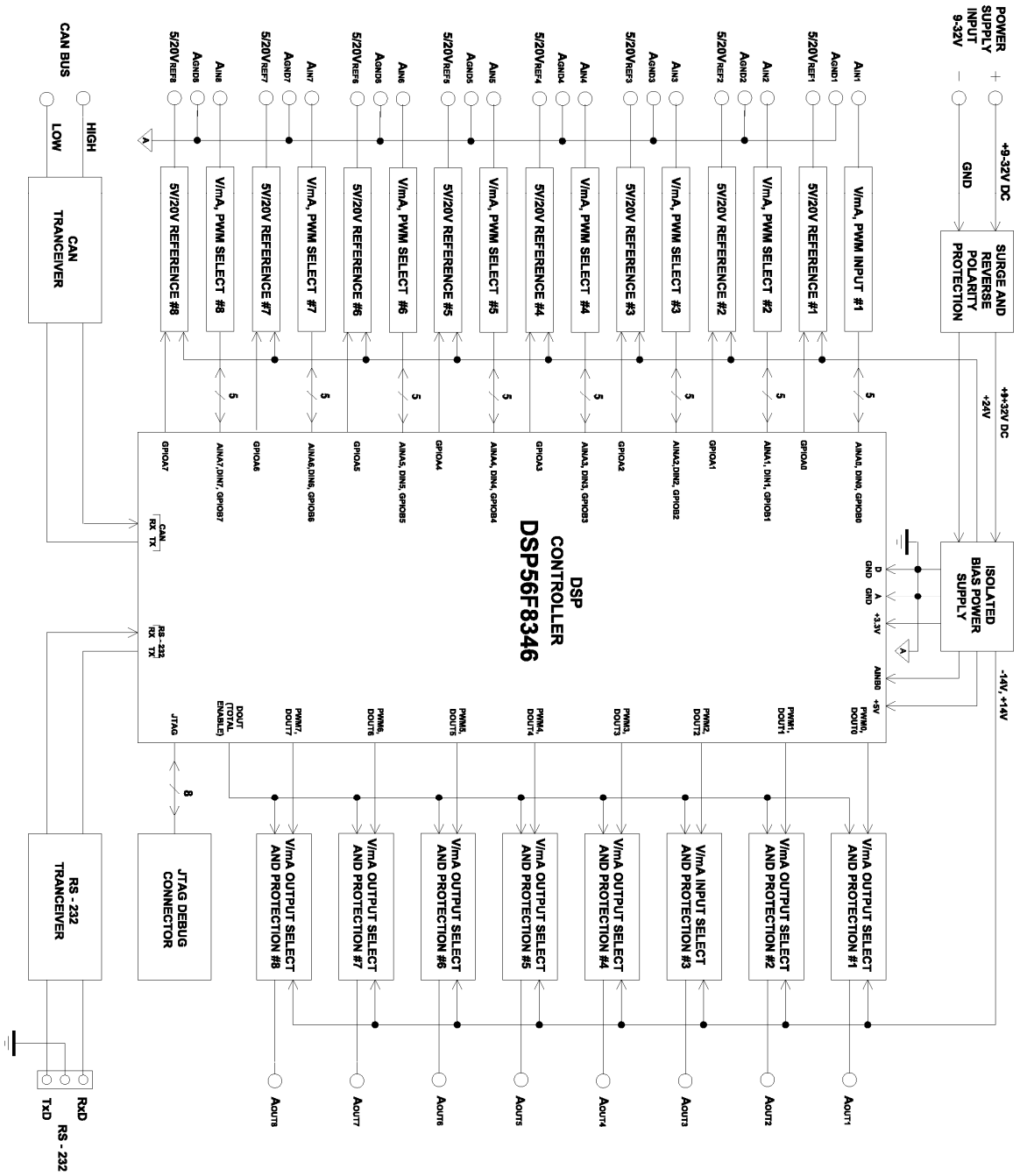
#### In Europe:

Axiomatic Technologies Oy  
Höytämöntie 6  
33880 LEMPÄÄLÄ - Finland  
Tel. +358 3 3595 600  
Fax. +358 3 3595 660  
www.axiomatic.fi

#### In North America:

Axiomatic Technologies Corporation  
5915 Wallace Street  
Mississauga, ON Canada L4Z 1Z8  
Tel. 1 905 602 9270  
Fax. 1 905 602 9279  
www.axiomatic.com

# BLOCK DIAGRAM



## Technical Specifications:

### Input Power

Power Supply Input - Nominal	<p>12, 24VDC nominal (9...32 VDC power supply range) Surge protection is provided.</p> <p>If batteries are used, an alternator or other battery-charging device is necessary to maintain a stable supply voltage. Central suppression of any surge events should be provided at the system level. The installation of the equipment must include overcurrent protection between the power source and the module by means of a series connection of properly rated fuses or circuit breakers. Input power switches must be arranged external to the Thermocouple Module.</p> <p>Power input wiring should be limited to 10 meters.</p>
Reverse Polarity Protection	Provided

### Input Signals

All Inputs	<p>Up to 8 inputs are selectable by the user. All inputs, except for frequency, are sampled every 1ms. The user can select the type of filter that is applied to the measured data, before it is transmitted to the bus. The available filters are:</p> <ul style="list-style-type: none"> <li>• Filter Type 0 = No Filter</li> <li>• Filter Type 1 = Moving Average</li> <li>• Filter Type 2 = Repeating Average</li> </ul> <p>With the CAN model, AX030200, all input channels are completely independent of each other as well as can simultaneously control an on-board output and send a message to the J1939 bus. There are five setpoints per channel that are associated with the input and how the data is measured. There are four setpoints per channel that are associated with how the measured input will control an output on the controller. <i>Refer to the user manual for details.</i></p>
Input Configuration	<p>Up to 8 inputs are available. <i>Refer to Table 1.0.</i> Each input can be configured for any one of the following options.</p> <ul style="list-style-type: none"> <li>• Disable input</li> <li>• 0...5VDC or 0...10VDC</li> <li>• 4...20mA or 0...20mA</li> <li>• Digital input</li> <li>• PWM signal</li> <li>• Pulse (Hz or RPM)</li> <li>• 16-bit Counter</li> </ul>
Threshold Levels	<p>For digital, PWM, pulse or counter inputs the voltage threshold levels are: <u>Input positive threshold (signal goes from low to high):</u> Min. 2.2V, typical 2.9V, max. 3.6V <u>Input negative threshold (signal goes from high to low):</u> Min. 1.2V, typical 1.7V, max. 2.3V</p>
Analog GND	8 Analog GND connections are provided.
Voltage References	8 +5V references (sourcing up to 10 mA) +/- 0.1% or 8 20 mA constant (voltage up to power supply) +/-0.2%
Input Accuracy	<p>0-5V: +/- 0.3% 0-10V: +/- 0.2% 0-20mA: +/- 0.35% PWM, single channel: +/- 0.05% to +/- 1.25% (over the 500 Hz to 10 kHz range) (NOTE: When selecting all input types as "PWM Duty Cycle" the inputs will be accurate at frequencies above 3 kHz.) Frequency/RPM, single channel: +/- 1% 16-bit counter, single channel: +/- 3 mSec (@50 Hz)</p>
Input Resolution	<p>0-5V: 1 mV resolution 0-10V: 1 mV resolution 0-20mA: 1 µA resolution PWM, single channel: +/- 0.05% to +/- 1.25%, 2 decimal place resolution NOTE: If the Input Maximum setpoint is set for a low frequency (&lt;=50Hz), the controller will use a different technique to measure the frequency. Instead of measuring the pulses in the Measuring Window (this parameter is ignored) it will measure the time between rising edges of the signal. If more than 10 seconds pass without a transition, the input will be read as zero. The frequency range in this mode is 0.5-50Hz, with up to 2 decimal places of resolution. Frequency/RPM (single channel) 0.5 Hz to 50 Hz: +/- 0.01Hz, 2 decimal place resolution 50 Hz to 10kHz: +/- 1Hz, 0 decimal place resolution 16-bit counter, single channel: 1 pulse resolution</p>
Input Scan Rate	1 mSec.
Input Impedance	<p>Voltage 1 MOhm Current 250 Ohms PWM, frequency, 16-bit counter 1 MOhm</p>

<b>Table 1.0 Description of Inputs to AX030200</b>	
<b>Input Type</b>	<b>Description</b>
<b>Disable Inputs</b>	Each input can be configured as a disable input command. When disable is selected, no CAN messages associated with that channel are sent to the network.
<b>Universal Analog Inputs</b>	Up to 8 analog inputs are available. 0...5VDC or 0...10VDC The offset is in volts and the resolution setpoint is V/bit, when sending a CAN message. Error detection setpoints are interpreted in volts. 4...20mA or 0...20mA The offset is in milliamps and the resolution setpoint is mA/bit, when sending a message. Error detection setpoints are interpreted in milliamps.
<b>Digital Inputs</b>	Up to 8 digital inputs are available. The input accepted is active high (switch is connected to a +V signal when ON). The controller interprets 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.
<b>PWM Signal Inputs</b>	Up to 8 PWM inputs are available to interface to a PWM signal from an ECM, PLC, etc. PWM Signal Frequency: 50 – 10,000 Hz Amplitude: 5-12V PWM Duty Cycle: 0 to 100% The offset is interpreted as percent duty cycle (%dc) and the resolution setpoint as %dc/bit, when sending the CAN message. Error detection setpoints will be interpreted in %dc.  NOTE: If the Input Maximum setpoint is set for a low frequency (<=50Hz), the controller will use a different technique to measure the frequency. Instead of measuring the pulses in the Measuring Window (this parameter is ignored) it will measure the time between rising edges of the signal. If more than 10 seconds pass without a transition, the input will be read as zero. The frequency range in this mode is 0.5-50Hz, with up to 2 decimal places of resolution.
<b>Pulse Inputs</b>	Up to 8 pulse inputs are available. This input counts the number of pulses over the period of the measuring window setpoint and calculates the frequency of the pulses. Hz = With a pulse per revolution of 0, the controller calculates the offset in Hz and the resolution setpoint as Hz/bit, when sending the CAN message. Error detection setpoints are in Hertz. RPM = With a non-zero pulse per revolution, the frequency is interpreted as a RPM input. The offset is in revolutions per minute (RPM) and the resolution setpoint is RPM/bit. Error detection setpoints are interpreted in RPM.  NOTE: The difference between Frequency and Counter mode is that the Frequency mode measures the number of pulses that occur in the Measuring Window period and calculates frequency, while the counter gives the period of time (in milliseconds) it takes for the number of pulses in the Measuring Window to be read at the input.
<b>16-bit Counter Inputs</b>	Up to eight 16-bit counter inputs are available. A counter input cannot be used to control an output. The input is configured to count pulses on the input until the value in the measuring window setpoint is reached. While the counter is active, a timer with a 1ms resolution is running in the background. When the count has been reached, the value in the 1ms timer is captured and updated to the input feedback variable. The timer is reset until the count value once again reaches the measuring window. Input and error detection setpoints are not used, since error detection is not possible in this mode.  NOTE: If set to be a 16-bit counter, the input can no longer be used as either a control signal or an enable input to any of the outputs on the ECU.

## Outputs

Analog Outputs	<p>8 Analog outputs User selectable (0-5V, 0-10V, +/-5V, +/-10V, 0-20 mA, 4-20 mA)</p> <p>Each analog output can be configured for one of the following options, and the properties and behavior of the output in each mode is described below in Table 2.0.</p> <table border="1" data-bbox="592 304 1372 913"> <thead> <tr> <th colspan="2" data-bbox="592 304 1372 336"><i>Table 2.0 Analog Outputs</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="592 336 812 441">0 to 5 Volts</td> <td data-bbox="812 336 1372 441">The output is configured to drive a voltage output in the range of 0V to 5V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a 0mV offset.</td> </tr> <tr> <td data-bbox="592 441 812 567">-5 to 5 Volts</td> <td data-bbox="812 441 1372 567">The output is configured to drive a voltage output in the range of -5V to 5V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a -5000mV offset.</td> </tr> <tr> <td data-bbox="592 567 812 682">0 to 10 Volts</td> <td data-bbox="812 567 1372 682">The output is configured to drive a voltage output in the range of 0V to 10V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a 0mV offset.</td> </tr> <tr> <td data-bbox="592 682 812 808">-10 to 10 Volts</td> <td data-bbox="812 682 1372 808">The output is configured to drive a voltage output in the range of -10V to 10V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a -10000mV offset.</td> </tr> <tr> <td data-bbox="592 808 812 913">0(4) to 20 Milliamps</td> <td data-bbox="812 808 1372 913">The output is configured to source a current in the range of 0mA to 20mA. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1uA/bit, and a 0uA offset.</td> </tr> </tbody> </table>	<i>Table 2.0 Analog Outputs</i>		0 to 5 Volts	The output is configured to drive a voltage output in the range of 0V to 5V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a 0mV offset.	-5 to 5 Volts	The output is configured to drive a voltage output in the range of -5V to 5V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a -5000mV offset.	0 to 10 Volts	The output is configured to drive a voltage output in the range of 0V to 10V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a 0mV offset.	-10 to 10 Volts	The output is configured to drive a voltage output in the range of -10V to 10V. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1mV/bit, and a -10000mV offset.	0(4) to 20 Milliamps	The output is configured to source a current in the range of 0mA to 20mA. If feedback messages are used to send the output value to the bus, then the message will be sent with a resolution of 1uA/bit, and a 0uA offset.
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Output Accuracy	Voltage Output: +/- 0.4% Current Output: +/- 0.4%												
Output Resolution	15-bit PWM												
Output Adjust Rate	1 mSec.												
Output Response	<p>For each output type, if the control signal is one of the inputs on the board, then there are up to six output profiles that can be selected to determine how the output will react to a change at the input. Refer to Figures 1, 2 and 3 below.</p> <p><i>Note 1. If the control input is set to a digital type, the output will jump to the maximum setpoint when the input is ON and jump to the minimum setpoint when the input is OFF.</i></p> <p><i>Note 2: For outputs that are controlled using a J1939 Command Message, only the "Single Profile" responses will be used (single or dual slope).</i></p>												
Output Setpoints	There are six setpoints that will determine how an input controls the output's behavior. There are four setpoints that define an output type and response. There are five setpoints that define an output's behavior depending on the profile used.												
Short Circuit Protection	Individual short circuit protection is provided.												
Other Protection	Each output is protected against miswiring.												
Accuracy	0.5%												
Response Time	1 mSec.												
Output Short Circuit Protection	Fully protected (all physical pins, all inputs, outputs and power)												

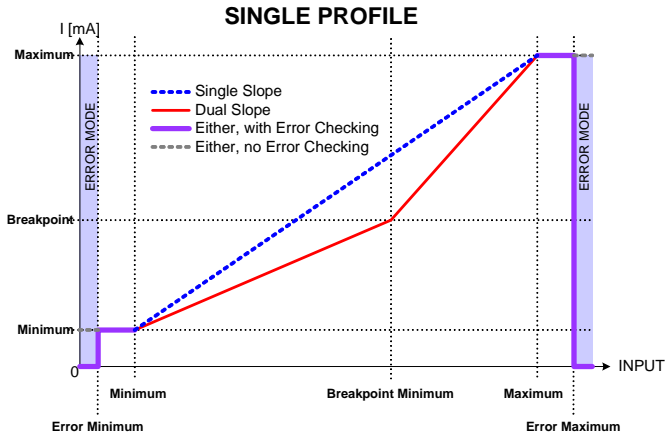


Figure 1 – Analog Output Single Profile

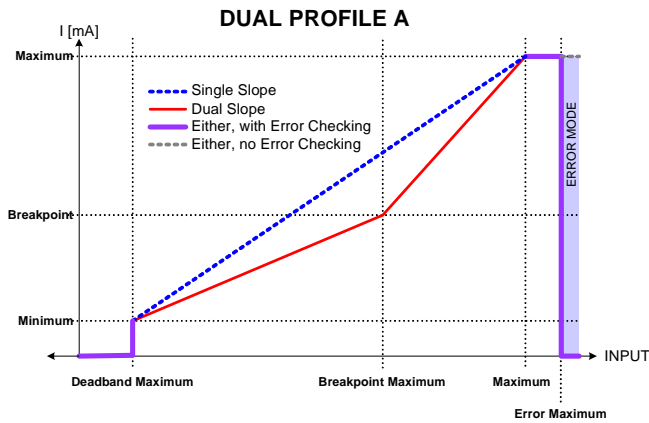


Figure 2 – Analog Output Dual Profile A

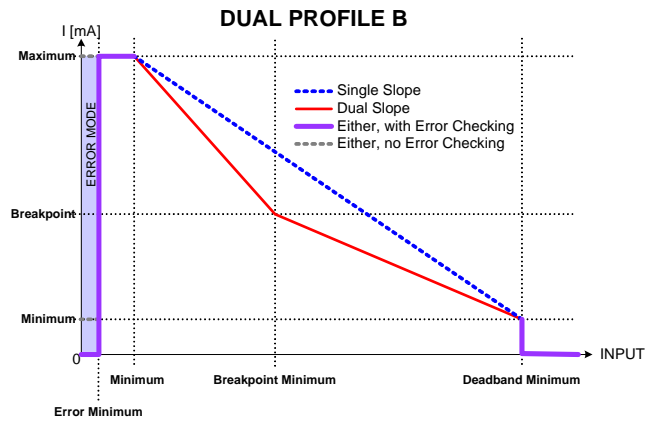


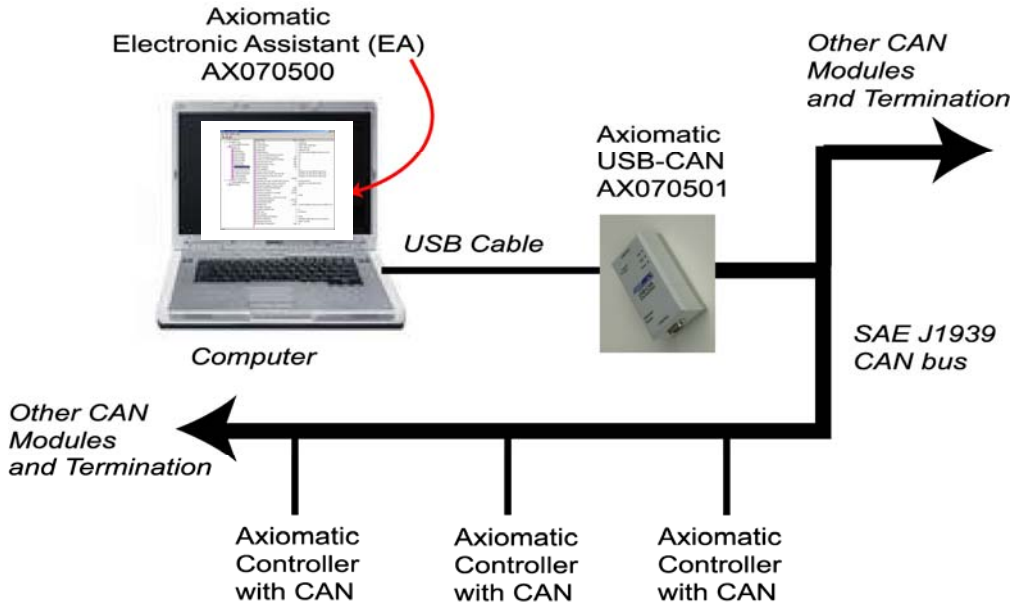
Figure 3 – Analog Output Dual Profile B

## General Specifications

Microprocessor	DSP56F8346		
Control Logic	Standard embedded software is provided. <i>Refer to the user manual for details.</i> (Application-specific control logic is available on request.)		
Quiescent Current Draw	BATT+ Voltage (V)	Quiescent Current (ma)	Power - Watts (W)
	9	269.8	2.43
	10	241.8	2.42
	11	220.3	2.42
	12	200.5	2.41
	15	159.3	2.39
	20	115.1	2.30
	24	95.9	2.30
	28	82.4	2.31
32	72.4	2.32	
Communications	1 CAN port (SAE J1939) (CANopen® on request) 1 RS-232		

User Interface	<p>Electronic Assistant® for <i>Windows</i> operating systems It comes with a royalty-free license for use.</p> <p>The Electronic Assistant® requires an USB-CAN converter to link the device's (AX030200) CAN port to a <i>Windows</i>-based PC for initial configuration. An Axiomatic USB-CAN Converter AX070501 is available. Order the EA and USB-CAN as a kit (P/N AX070502), which includes all interconnecting cables. Refer to Table 3.0 for details.</p>
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**Set up of AX030200 Controller on a CAN 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 can be placed between CAN\_H and CAN\_L terminals at both ends of the network.

*Table 3.0 - Electronic Assistant® and AX070501 USB-CAN*

<p>The <b>Electronic Assistant®</b> (EA) is a software configuration tool that runs on a PC connected to a J1939 bus via a USB to CAN converter, AX070501. Upon being connected to the bus, the EA will find all Electronic Control Units (ECU) on the bus and recognize those manufactured by Axiomatic. Using this tool, a user can quickly configure an Axiomatic ECU for the desired performance over a wide variety of applications.</p> <p>Axiomatic <b>CAN Assistant – Scope</b> software monitors CAN messages in a text format and is able to send single frames to the CAN bus. It is useful for PC-based debugging of J1939, CANopen or proprietary networked devices.</p> <p>The <b>CAN Assistant – Visual</b> software presents J1939 data in a graphic and user-friendly text format.</p> <p>The Axiomatic <b>USB-CAN Converter</b> includes a Software Development Kit (SDK). The SDK is designed to allow independent software developers and system integrators to use Axiomatic USB-CAN Converter hardware, AX070501, in their own applications.</p>	<p><b>AX070502</b>, 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 &amp; USB-CAN User Manual UMAX07050X; USB-CAN drivers &amp; documentation; CAN Assistant (Scope and Visual) software &amp; documentation; and the Software Development Kit.  <b>NOTE: To order this kit, you need only to specify P/N: AX070502.</b></p>
 <p><b>AX070502, Configuration KIT</b></p>	

## Electronic Assistant®

The Electronic Assistant (EA) runs on any modern PC with the Microsoft Windows® 2000 operating system or higher. It comes with a royalty-free license for use.

### System Requirements:

Operating System: *Windows* 2000 or higher including 64-bit editions

Port: USB 1.1 or 2.0 full speed

Display: VGA (XGA or better with 1024 x 768 recommended)

### Setup and Configuration:

Refer to the User Manual UMAX07050X.

To order the EA software at the time of initial purchase, order the KIT AX070502 (see above) which includes the USB-CAN converter.

For additional EA and USB-CAN software ONLY CD's, use ordering P/N: CD-AX070502.

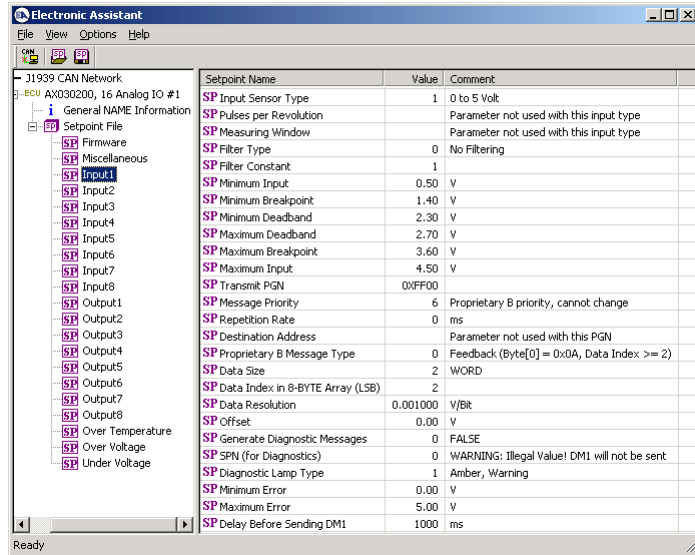


Figure 4.0 Configuration screen from the Electronic Assistant®

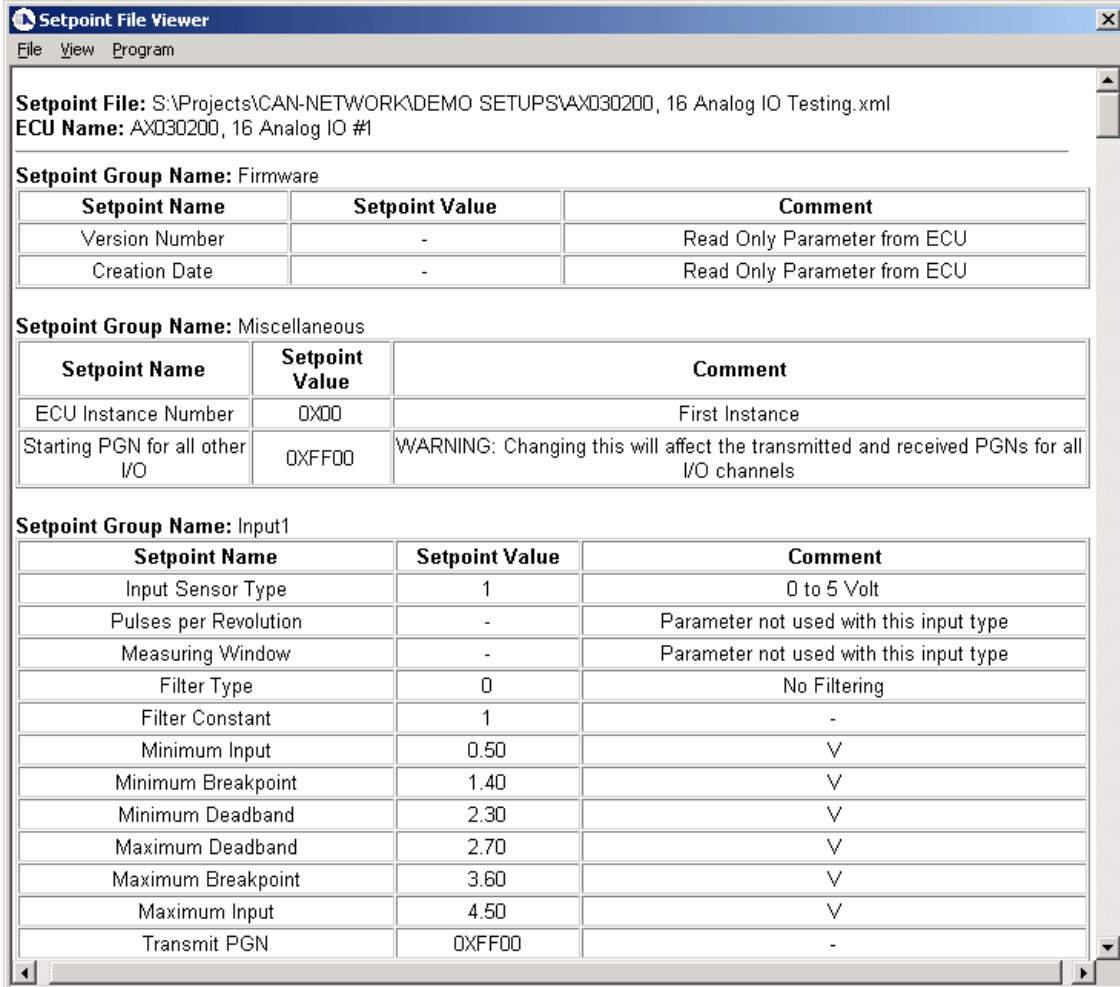
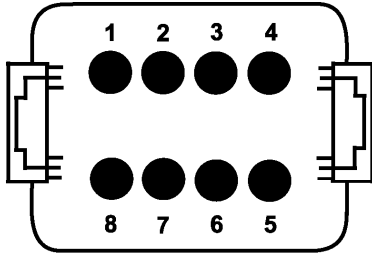
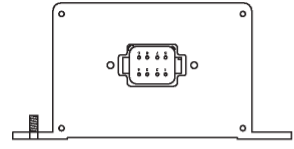
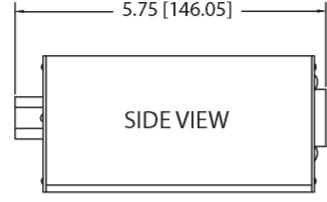
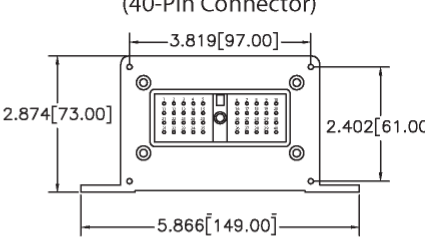
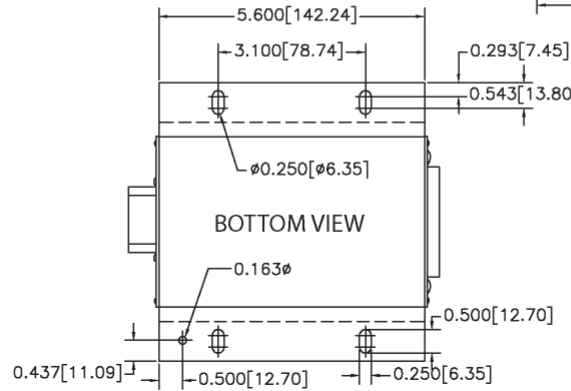


Figure 5.0 Viewing Setpoint Files

CAN Interface	<p>1 CAN port (SAE J1939)</p> <p>The software was designed to provide flexibility and provides the following.</p> <ul style="list-style-type: none"> <li>• Configurable ECU Instance in the NAME (for multiple ECU's on the network)</li> <li>• Configurable Input Parameters</li> <li>• Configurable Output Parameters</li> <li>• Configurable PGN and Data Parameters</li> <li>• Configurable Diagnostic Messaging Parameters, as required</li> <li>• Diagnostic Log, maintained in non-volatile memory</li> </ul> <p><i>Note: Configurable parameters are also called setpoints.</i></p> <p>Any input or output on the controller by default uses a Proprietary B message to send data to the network bus. There are nine setpoints per channel that are associated with the J1939 message that is sent to the network bus. There are twelve setpoints per channel that are associated with the J1939 command message that is received by the ECU from the network bus. There are three setpoints per channel that are associated with the J1939 feedback message that can be sent by the ECU to the network bus. There are six setpoints per input channel and seven per fault, that are associated with if and how diagnostic messages will be sent to the network bus. <i>To use J1939 capabilities, refer to the user manual.</i></p> <p>The Axiomatic AX030200 is compliant with Bosch CAN protocol specification, Rev.2.0, Part B, and the following J1939 standards.</p> <table border="1" data-bbox="602 705 1378 1740"> <thead> <tr> <th colspan="2" data-bbox="602 705 1378 741"><i>Table 4: J1939 Compliance</i></th> </tr> <tr> <th data-bbox="602 741 824 793">OSI Network Model Layer</th> <th data-bbox="824 741 1378 793">J1939 Standard</th> </tr> </thead> <tbody> <tr> <td data-bbox="602 793 824 869">Physical</td> <td data-bbox="824 793 1378 869">J1939/11 – Physical Layer, 250K bit/s, Twisted Shielded Pair. J1939/15 - Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP).</td> </tr> <tr> <td data-bbox="602 869 824 1045" rowspan="2">Data Link</td> <td data-bbox="824 869 1378 905">J1939/21 – Data Link Layer</td> </tr> <tr> <td data-bbox="824 905 1378 1045">The controller 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 described in the User Manual.</td> </tr> <tr> <td data-bbox="602 1045 824 1222" rowspan="2">Network Layer</td> <td data-bbox="824 1045 1378 1108">J1939/81 – Network Management J1939, Appendix B – Address and Identity Assignments</td> </tr> <tr> <td data-bbox="824 1108 1378 1222">Arbitrary Address Capable ECU - It can dynamically change its network address in real time. The controller supports: Address Claimed Messages (PGN 60928), Requests for Address Claimed Messages (PGN 59904) and Commanded Address Messages (PGN 65240).</td> </tr> <tr> <td data-bbox="602 1222 824 1740" rowspan="3">Application Layer</td> <td data-bbox="824 1222 1378 1257">J1939/71 – Vehicle Application Layer</td> </tr> <tr> <td data-bbox="824 1257 1378 1461">None of the application layer PGN's are supported as part of the default configurations. However, the controller could be configured such that any of the input messages to be sent will use a PGN from this section, or for the outputs to respond to the data in a message with a PGN from this section. The data size, index, resolution and offset can all be configured for the appropriate SPN associated with the PGN. <i>It is the user's responsibility to configure the controller such that it will not violate the J1939 standard.</i></td> </tr> <tr> <td data-bbox="824 1461 1378 1740">J1939/73 – Application Layer – Diagnostics  The controller can be configured to send "Active Diagnostic Trouble Code" DM1 messages (PGN 65226) for any I/O channel. 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 DTC's" DM11 message (PGN 65235). Occurrence counts in the diagnostic log will be cleared upon receiving a "Diagnostic Data Clear/Reset for Previously Active DTC's" DM3 message (PGN 65228).</td> </tr> </tbody> </table>	<i>Table 4: J1939 Compliance</i>		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 controller 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 described in the User Manual.	Network Layer	J1939/81 – Network Management J1939, Appendix B – Address and Identity Assignments	Arbitrary Address Capable ECU - It can dynamically change its network address in real time. The controller 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 controller could be configured such that any of the input messages to be sent will use a PGN from this section, or for the outputs to respond to the data in a message with a PGN from this section. The data size, index, resolution and offset can all be configured for the appropriate SPN associated with the PGN. <i>It is the user's responsibility to configure the controller such that it will not violate the J1939 standard.</i>	J1939/73 – Application Layer – Diagnostics  The controller can be configured to send "Active Diagnostic Trouble Code" DM1 messages (PGN 65226) for any I/O channel. Warning and Protect diagnostics will automatically become previously active when cleared. 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Diagnostics	<p>Each input channel can be configured to send diagnostic messages to the network if the input goes out of range, as described below. In addition to the input channels, three other types of faults can be reported to the network using diagnostic messaging. They are Over Temperature (of the controller processor), Over Voltage and Under Voltage (of the power supply voltage). For each fault condition, there are two setpoints, one that will cause the fault condition to trigger, and the other that will clear the fault. Even if diagnostic messaging is not enabled, the Minimum and Maximum Error setpoints can be used to flag an error using the Axiomatic Proprietary B scheme. <i>Refer to the user manual for details.</i></p> <p>Note: If the Input Sensor Type setpoint is set to either 16-bit Counter or Digital, diagnostics are not permitted for that channel. Otherwise, whether or not faults will be detected for an input channel is dependent on the settings of the "Minimum Error" and "Maximum Error" setpoints. <i>If these are set to the limits of the range (i.e. 0V or 5V), then fault detection is not possible.</i></p>																																																																																																												
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Electrical Connections	<p>8-pin Deutsch IPD P/N: DT13-08PA  Mating plug p/n: DT06-08SA with wedge W8S and sockets 0462-201-16141  40-pin Deutsch IPD p/n: DRC13-40PA  Mating plug p/n: DRC16-40SA or DRC18-40SA with sockets 0462-201-16141</p> <div style="text-align: center;">  <p>1 = PWR+    5 = SHIELD  2 = CAN-H    6 = RS-232 GND  3 = CAN-L    7 = RS-232 TXD  4 = PWR-    8 = RS-232 RXD</p> <p><b>FRONT VIEW  MODULE MOUNTED CONNECTOR  DEUTSCH P/N: DT13-08PA</b></p> <p>(Mating plug is DT06-08SA with wedge W8S and sockets 0462-201-16141)</p> </div> <div style="text-align: center; margin-top: 20px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 10%;">+VREF</th> <th style="width: 10%;">A-IN</th> <th style="width: 10%;">AGND</th> <th style="width: 10%;">+VREF</th> <th style="width: 10%;">A-IN</th> <th style="width: 10%;"></th> <th style="width: 10%;">AGND</th> <th style="width: 10%;">OUT/ GND</th> <th style="width: 10%;">OUT/ GND</th> <th style="width: 10%;">OUT/ GND</th> <th style="width: 10%;">OUT/ GND</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>5</td> <td>●</td> <td>6</td> <td>●</td> <td>●</td> <td>●</td> </tr> <tr> <td>11</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>15</td> <td>●</td> <td>16</td> <td>●</td> <td>●</td> <td>●</td> </tr> <tr> <td>21</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>25</td> <td>●</td> <td>26</td> <td>●</td> <td>●</td> <td>●</td> </tr> <tr> <td>31</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>●</td> <td>35</td> <td>●</td> <td>36</td> <td>●</td> <td>●</td> <td>●</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Out 1</td> <td>Out 2</td> <td>Out 3</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Out 4</td> <td>Out 5</td> <td>Out 6</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Out 7</td> <td>Out 8</td> <td>Out 9</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Out 10</td> <td>Out 11</td> <td>Out 12</td> </tr> </tbody> </table> <p><b>FRONT VIEW OF  MODULE MOUNTED CONNECTOR  DEUTSCH P/N: DRC13-40PA</b></p> </div>		+VREF	A-IN	AGND	+VREF	A-IN		AGND	OUT/ GND	OUT/ GND	OUT/ GND	OUT/ GND	1	●	●	●	●	●	5	●	6	●	●	●	11	●	●	●	●	●	15	●	16	●	●	●	21	●	●	●	●	●	25	●	26	●	●	●	31	●	●	●	●	●	35	●	36	●	●	●										Out 1	Out 2	Out 3										Out 4	Out 5	Out 6										Out 7	Out 8	Out 9										Out 10	Out 11	Out 12
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Packaging and Dimensions	Aluminum extrusion with stainless steel end plates. For dimensions, see below.
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>FRONT VIEW (8-Pin Connector)</p>  <p>Grounding Lug</p> </div> <div style="text-align: center;"> <p>SIDE VIEW</p>  </div> <div style="text-align: center;"> <p>BACK VIEW (40-Pin Connector)</p>  </div> </div> <div style="text-align: center; margin-top: 20px;"> <p>BOTTOM VIEW</p>  </div> <p style="text-align: right; margin-top: 10px;">Dimensions: inches [mm]</p>	
Grounding	<p>Protective Earth (PE) must be connected to the grounding stud to reduce the risk of electric shock. The conductor providing the connection should have a ring lug and wire larger than or equal to 4 mm<sup>2</sup> (12 AWG). The ring lug should be placed between the nut and a star washer. (To secure the ground strap, use an 8-32 "K-LOK" locknut, stainless steel, 3/8" O.D.)</p> <p>All chassis grounding should go to a single ground point designated for the machine and all related equipment.</p> <p>The ground strap that provides a low impedance path for EMI should be a ½ inch wide, flat, hollow braid, no more than 12 inches long with a suitable sized ring lug for the module's grounding lug. It may be used in place of the PE grounding conductor and would then perform both PE and EMI grounding functions.</p>
Shielding	<p>The CAN wiring should be shielded using a twisted conductor pair. All wire shields should be terminated externally to the grounding lug on the mounting foot. The input wires should not be exposed for more than 2 inches (50 mm) without shielding. Shields can be ac grounded at one end and hard grounded at the opposite end to improve shielding. If the module is installed in a cabinet, shielded wiring can be terminated at the cabinet (earth ground), at the entry to the cabinet or at the module.</p>
CAN Wiring	<p>The CAN port is electrically isolated from all other circuits. The isolation is SELV rated with respect to product safety requirements. Refer to the CAN specification for more information.</p> <p>Use CAN compatible cabling. J1939 cable is recommended as it is rated for on-engine use.</p> <p>Shielded CAN cable is required. The module provides the CAN port shield connection ac coupled to chassis ground. The chassis ground stud located on the mounting foot must be tied directly to Earth Ground.</p>
Network Construction	<p>Axiomatic recommends that multi-drop networks be constructed using a "daisy chain" or "backbone" configuration with short drop lines.</p>
Termination	<p>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.</p>

<p>Mounting</p>	<p>Mounting ledges include holes sized for ¼ inch or M6 bolts. The bolt length will be determined by the end-user's mounting plate thickness. Typically ¾ inch (20 mm) is adequate.</p> <p>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.</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 of the module.</p> <p>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).</p>
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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: TDAX030200-07/20/09