Features:
- 10 universal 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
- 2 voltage references can power external sensors
- 1 Resistive Input
- 1 Digital Input
- 8 analog outputs (0-5V, 0-10V, +/-5V, +/-10V, 0-20 mA, 4-20 mA)
- 1 Form C Relay Output
- 12/24VDC input power (nominal)
- 1 Isolated CAN (SAE J1939), CANopen® in model AX030211
- Rugged IP66 packaging and connectors
- Configure with Axiomatic Electronic Assistant

Description: The controller features 1 Isolated CAN port for user-defined communications over the bus. It accepts up to 10 analog (0-5V, 0-10V, 0-20 mA or 4-20 mA), digital, PWM, Frequency or RPM inputs. Two voltage references (user configurable as +5V or +10V) are provided to power external sensors. A digital input and a resistive input allow for additional interfaces. Each input 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) as well as 1 Form C relay output. Diagnostics messages are provided over the CAN network for the status of inputs or outputs. Rugged IP65 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:
- Analog I/O, SAE J1939 250 kbps P/N: AX030210
- Analog I/O, SAE J1939 500 kbps P/N: AX030210-01
- Analog I/O, SAE J1939 1 Mbps P/N: AX030210-02
- Analog I/O, CANopen P/N: AX030211

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

Accessories:
- Configuration Tool: Electronic Assistant P/N: AX070502
- Mating plug kit: AX070200 (8-pin and 40-pin, no key)
### Technical Specifications:

#### Input Power

**Power Supply Input - Nominal**
- 12, 24VDC nominal (8…36 VDC power supply range)
- Surge protection is provided.

If batteries are used, an alternator or another 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 Axiomatic Control Module.

- Power input wiring should be limited to 10 meters.

**Quiescent Current**
- 300 mA at 12 Vdc Typical
- 155 mA at 24 Vdc Typical
- Inrush does not exceed 500 mA.

**Protection**
- Reverse polarity protection is provided.
- Power supply input section protects against transients, surges (per IEC 60533, Table 4) and short circuits and is isolated from inputs.
- Undervoltage protection is provided and hardware shuts down at 7.5Vdc.
- Over-voltage protection is provided, and hardware shuts down at 41Vdc.
Inputs

Universal Signal Inputs

Up to 10 inputs are selectable by the user. All inputs, except for frequency, are sampled every 1 ms. 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:

- Filter Type 0 = No Filter
- Filter Type 1 = Moving Average
- Filter Type 2 = Repeating Average

Universal Signal Input Configuration

Up to 10 inputs are available. Refer to Table 1.0. Each input can be configured for any one of the following options.

- Disable input
- 0…5VDC or 0…10VDC
- 4…20mA or 0…20mA
- Digital input
- PWM signal
- Pulse (Hz or RPM)
- 16-bit Counter

Input Protections

All inputs are protected against short circuits to GND or +Vcc.

Resistive Input

One resistive type input
1 Ohm resolution
+/- 1 % accuracy
Self-calibrating in the range of 25 Ohms to 250 kOhms

Analog GND

10 Analog GND connections are provided. The grounds are connected internally in the module.
1 Resistive Input GND connection is provided.

Voltage References

2 +5V references (sourcing up to 100 mA) +/- 0.1%
or 2 +10V references (sourcing up to 100 mA) +/-0.2%

Input Scan Rate

1 mSec.

Digital Input

One Digital Input
Active High or Active Low
Configurable 10 kΩ pullup or pulldown resistor

PWM Signal Inputs

Up to 10 PWM inputs are available to interface to a PWM signal from an ECM, PLC, etc.
PWM Signal Frequency: 0.50 – 10,000 Hz
Amplitude: 5-12V
PWM Duty Cycle: 0 to 100%

Pulse Inputs

Up to 10 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.

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.

16-bit Counter Inputs

Up to ten 16-bit counter inputs are available. The input is configured to count pulses on the input until the value in the measuring window setpoint is reached.

Threshold Levels

For digital, PWM, pulse or counter inputs the voltage threshold levels are:

- Input positive threshold (signal goes from low to high): Min. 2.2V, typical 2.9V, max. 3.6V
- Input negative threshold (signal goes from high to low): Min. 1.2V, typical 1.7V, max. 2.3V

Input Accuracy

- 0-5V: +/- 1%
- 0-10V: +/- 1%
- 0-20mA or 4-20 mA: +/- 1%
- PWM, single channel: +/- 1%
- Frequency/RPM, single channel: +/- 1%
- 16-bit counter, single channel: +/- 3 mSec (@50 Hz)

Input Resolution

- 0-5V or 0-10V: 1 mV
- 0-20mA or 4-20 mA: 1µA

Input Impedance

Voltage 1 MOhm
Current 124Ω
PWM, frequency, 16-bit counter 1 MOhm
Outputs

Analog Outputs

- 8 Analog outputs
- 16-bit Digital to Analog
- User selectable (0-5V, 0-10V, +/-5V, +/-10V, 0-20 mA, 4-20 mA)

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.

<table>
<thead>
<tr>
<th>Table 2.0 Analog Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5 Volts</td>
<td>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>-5 to 5 Volts</td>
<td>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>0 to 10 Volts</td>
<td>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>-10 to 10 Volts</td>
<td>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>0(4) to 20 Milliamps</td>
<td>The output is configured to source a current in the range of 0(4)mA 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. Compliance voltage is up to 32Vdc.</td>
</tr>
</tbody>
</table>

Output Accuracy
- Voltage Output: +/- 0.2%
- Current Output: +/- 0.4%

Output Resolution
- Voltage: 1 mV
- Current: 0.5 µA

Output Grounds
- 8 Analog Output GNDs are connected internally.

Output Adjust Rate
- Approximately 1 mSec.

Short Circuit Protection
- Individual short circuit protection is provided.

Other Protection
- Each output is protected against shorts to GND or +Vcc.

Output Short Circuit Protection
- Fully protected (all physical pins, all inputs, outputs and power)

Relay Output
- 1 Form C Relay
- NC
- 3 contact pins per output
- Maximum electrical endurance at contact:
  - 0.25A @ 250Vac
  - 0.5A @ 125Vac
  - 0.24A @ 125Vdc
  - 2A @ 30Vdc

General Specifications

Microprocessor
- STM32F407ZG, ARM Cortex M4
- 32-bit, 1 Mbyte Flash Memory, 196 Kbyte SRAM

Control Logic
- Standard embedded software is provided.
- Refer to the user manual for details.
  (Application-specific control logic is available on request.)

CAN Interface
- 1 CAN port (SAE J1939) (CANopen® model: AX030211)
  - Model AX030210: 250 kbps Baud Rate
  - Model AX030210-01: 500 kbps Baud Rate
  - Model AX030210-02: 1 Mbps Baud Rate
  - Digital isolation is provided for the CAN line.

Isolation
- 300Vrms Isolation for the CAN port

User Interface, Reflashing
- Axiomatic Electronic Assistant AX070502
CAN (SAE J1939) The software was designed to provide flexibility and provides the following.
- Configurable ECU Instance in the NAME (for multiple ECU’s on the network)
- Configurable Input Parameters
- Configurable Output Parameters
- Configurable PGN and Data Parameters
- Configurable Diagnostic Messaging Parameters, as required
- Diagnostic Log maintained in non-volatile memory

Note: Configurable parameters are also called setpoints.

To use J1939 capabilities, refer to the user manual.

The Axiomatic AX030210 is compliant with Bosch CAN protocol specification, Rev.2.0, Part B, and the following J1939 standards.

<table>
<thead>
<tr>
<th>OSI Network Model Layer</th>
<th>J1939 Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Link</td>
<td>J1939/21 – Data Link Layer</td>
</tr>
<tr>
<td></td>
<td>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>Network Layer</td>
<td>J1939/81 – Network Management J1939, Appendix B – Address and Identity Assignments</td>
</tr>
<tr>
<td></td>
<td>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>Application Layer</td>
<td>J1939/71 – Vehicle Application Layer</td>
</tr>
<tr>
<td></td>
<td>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. It is the user’s responsibility to configure the controller such that it will not violate the J1939 standard.</td>
</tr>
<tr>
<td></td>
<td>J1939/73 – Application Layer – Diagnostics</td>
</tr>
<tr>
<td></td>
<td>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>
### Operating Conditions
-40 to 85°C (-40 to 185°F)

### Protection
Designed to IP66, Unit is conformally coated in the housing. Tested to IP56 for marine type approval.

### Weight
2.20 lbs. (0.99 kg)

### Compliance
Designed to be compliant for EMC
Marine Type Approval - pending

### Vibration
MIL-STD-202G, Test 204D and 214A (Sine and Random)
10 g peak (Sine); 7.86 Grms peak (Random)

### Shock
MIL-STD-202G, Test 213B, 50 g

### Enclosure and Dimensions
Aluminum extrusion with stainless steel end plates.
Gaskets are open cell neoprene.
For dimensions, see below.

### Electrical Connections
- 1 8-pin TE Deutsch P/N: DT13-08PA
- Mating plug p/n: DT06-08SA with wedge W8S and sockets 0462-201-16141

<table>
<thead>
<tr>
<th>P/N#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BATT +</td>
</tr>
<tr>
<td>2</td>
<td>CAN_H</td>
</tr>
<tr>
<td>3</td>
<td>CAN_L</td>
</tr>
<tr>
<td>4</td>
<td>BATT -</td>
</tr>
<tr>
<td>5</td>
<td>DIGITAL INPUT</td>
</tr>
<tr>
<td>6</td>
<td>Relay Output NO</td>
</tr>
<tr>
<td>7</td>
<td>Relay Output NC</td>
</tr>
<tr>
<td>8</td>
<td>Relay Output COM</td>
</tr>
</tbody>
</table>
Mating plug p/n: DRC16-40SA or DRC18-40SA with sockets 0462-201-16141

<table>
<thead>
<tr>
<th>PIN#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UNIVERSAL INPUT 2_GND</td>
</tr>
<tr>
<td>2</td>
<td>UNIVERSAL INPUT 4_GND</td>
</tr>
<tr>
<td>3</td>
<td>UNIVERSAL INPUT 6_GND</td>
</tr>
<tr>
<td>4</td>
<td>UNIVERSAL INPUT 8_GND</td>
</tr>
<tr>
<td>5</td>
<td>+V Reference 2</td>
</tr>
<tr>
<td>6</td>
<td>RESISTIVE INPUT_GND</td>
</tr>
<tr>
<td>7</td>
<td>ANALOG OUTPUT 1</td>
</tr>
<tr>
<td>8</td>
<td>ANALOG OUTPUT 2</td>
</tr>
<tr>
<td>9</td>
<td>ANALOG OUTPUT 3</td>
</tr>
<tr>
<td>10</td>
<td>ANALOG OUTPUT 4</td>
</tr>
<tr>
<td>11</td>
<td>UNIVERSAL SIGNAL INPUT 2</td>
</tr>
<tr>
<td>12</td>
<td>UNIVERSAL SIGNAL INPUT 4</td>
</tr>
<tr>
<td>13</td>
<td>UNIVERSAL SIGNAL INPUT 6</td>
</tr>
<tr>
<td>14</td>
<td>UNIVERSAL SIGNAL INPUT 8</td>
</tr>
<tr>
<td>15</td>
<td>UNIVERSAL INPUT 9_GND</td>
</tr>
<tr>
<td>16</td>
<td>RESISTIVE INPUT</td>
</tr>
<tr>
<td>17</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>18</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>19</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>20</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>21</td>
<td>UNIVERSAL INPUT 1_GND</td>
</tr>
<tr>
<td>22</td>
<td>UNIVERSAL INPUT 3_GND</td>
</tr>
<tr>
<td>23</td>
<td>UNIVERSAL INPUT 5_GND</td>
</tr>
<tr>
<td>24</td>
<td>UNIVERSAL INPUT 7_GND</td>
</tr>
<tr>
<td>25</td>
<td>UNIVERSAL SIGNAL INPUT 9</td>
</tr>
<tr>
<td>26</td>
<td>UNIVERSAL INPUT 10_GND</td>
</tr>
<tr>
<td>27</td>
<td>ANALOG OUTPUT 8</td>
</tr>
<tr>
<td>28</td>
<td>ANALOG OUTPUT 7</td>
</tr>
<tr>
<td>29</td>
<td>ANALOG OUTPUT 6</td>
</tr>
<tr>
<td>30</td>
<td>ANALOG OUTPUT 5</td>
</tr>
<tr>
<td>31</td>
<td>UNIVERSAL SIGNAL INPUT 1</td>
</tr>
<tr>
<td>32</td>
<td>UNIVERSAL SIGNAL INPUT 3</td>
</tr>
<tr>
<td>33</td>
<td>UNIVERSAL SIGNAL INPUT 5</td>
</tr>
<tr>
<td>34</td>
<td>UNIVERSAL SIGNAL INPUT 7</td>
</tr>
<tr>
<td>35</td>
<td>+V Reference 1</td>
</tr>
<tr>
<td>36</td>
<td>UNIVERSAL SIGNAL INPUT 10</td>
</tr>
<tr>
<td>37</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>38</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>39</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
<tr>
<td>40</td>
<td>ANALOG OUTPUT_GND</td>
</tr>
</tbody>
</table>
This kit includes the following items. These items are also available from a local Deutsch IPD distributor.

NB. The sealing plugs are only needed in cases where not all of the 40 pins are used.

A crimping tool from Deutsch IPD is required to connect wiring to the sockets, P/N: HDT 48-00 or equivalent (not supplied).

<table>
<thead>
<tr>
<th>TE Deutsch P/N:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0462-201-16141</td>
<td>48 16AWG SOCKETS SOLID 16-20AWG WIRE 6mm</td>
</tr>
<tr>
<td>114017</td>
<td>24 SEALING PLUGS SIZE 12-16 CAVITIES 12-18 AWG</td>
</tr>
<tr>
<td>DRC16-40S</td>
<td>40-PIN PLUG, No Key</td>
</tr>
<tr>
<td>DT06-08SA</td>
<td>DT SERIES PLUG 8 CONTACTS</td>
</tr>
<tr>
<td>W8S</td>
<td>WEDGELOCK FOR DT 8 PIN PLUG</td>
</tr>
</tbody>
</table>

Grounding

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 mm² (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.)

All chassis grounding should go to a single ground point designated for the machine and all related equipment.

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.

Shielding

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.

CAN Wiring

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.

Use CAN compatible cabling. J1939 cable is recommended as it is rated for on-engine use.

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.

Network Construction

Axiomatic recommends that multi-drop networks be constructed using a “daisy chain” or “backbone” configuration with short drop lines.

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.
<table>
<thead>
<tr>
<th>Mounting</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>No wire or cable harness should exceed 30 meters in length. The power input wiring should be limited to 10 meters.</td>
</tr>
<tr>
<td></td>
<td>All field wiring should be suitable for the operating temperature range of the module.</td>
</tr>
<tr>
<td></td>
<td>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).</td>
</tr>
</tbody>
</table>

Note: CANopen® is a registered community trademark 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: TDAX030210-09/25/19