I/O Module, 12 Inputs, 8 Analog and 1 Relay Outputs, CANopen

10 Universal Signal Inputs
2 +5V/+10V References
1 Digital Input
1 Resistive Input
8 Analog Outputs
1 Relay Output
Isolated CAN (CANopen)
P/N: AX030211

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 (CANopen®)
• Rugged IP67 packaging and connectors
• EDS File
• Marine Type Approval pending

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 CANopen 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 IP67 rated packaging in addition to a 12 or 24V power supply input section suits power generation and large engine applications.

Applications: Power generation, Cogeneration, Stationary power, Large engines

Ordering Part Numbers:
Analog I/O, CANopen® P/N: AX030211

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

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

Input Power

<table>
<thead>
<tr>
<th>Power Supply Input - Nominal</th>
<th>12, 24VDC nominal (8…36 VDC power supply range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge protection is provided.</td>
<td></td>
</tr>
<tr>
<td>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 Axiomatic Control Module.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quiescent Current</th>
<th>300 mA at 12 Vdc Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>155 mA at 24 Vdc Typical</td>
<td></td>
</tr>
<tr>
<td>Inrush does not exceed 500 mA.</td>
<td></td>
</tr>
</tbody>
</table>

Protection

<table>
<thead>
<tr>
<th>Reverse polarity protection is provided.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply input section protects against transients, surges (per IEC 60533, Table 4) and short circuits and is isolated from inputs.</td>
</tr>
<tr>
<td>Undervoltage protection is provided and hardware shuts down at 7.5Vdc.</td>
</tr>
<tr>
<td>Over-voltage protection is provided, and hardware shuts down at 41Vdc.</td>
</tr>
</tbody>
</table>
## 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%
- 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 4-20mA: +/- 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 4-20mA: 1 µA

### Input Impedance

- Voltage 1 MΩhm
- Current (24Ω)
- PWM, frequency, 16-bit counter 1 MΩhm

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### Table 1.0 Description of Inputs to AX030210

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Inputs</td>
<td>Up to 10 analog inputs are available. 0…5VDC or 0…10VDC 4…20mA or 0…20mA</td>
</tr>
<tr>
<td>Digital Inputs</td>
<td>Up to 10 digital inputs are available. The input accepted is active high or active low. Configurable 10 kΩ pullup or pulldown resistor</td>
</tr>
<tr>
<td>PWM Signal Inputs</td>
<td>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%</td>
</tr>
<tr>
<td>Pulse Inputs</td>
<td>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. <strong>NOTE:</strong> 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.</td>
</tr>
<tr>
<td>16-bit Counter Inputs</td>
<td>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.</td>
</tr>
</tbody>
</table>
| 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 4-20mA: +/- 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 4-20mA: 1 µA
| Input Impedance  | Voltage 1 MΩhm
  - Current (24Ω)
  - PWM, frequency, 16-bit counter 1 MΩhm |
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 2.0 Analog Outputs |
|---|---|
| 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 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 1µA/bit, and a 0µA offset. Compliance voltage is up to 32Vdc. |

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 (CANopen®)
Digital isolation is provided for the CAN line.

Isolation
300Vrms Isolation for the CAN port

User Interface
EDS File
Standard CANopen® tools

Reflashing
Axiomatic Electronic Assistant A/070502
The Axiomatic AX030211 is compliant with CANopen protocol.

**Operating Conditions**
-40 to 85°C (-40 to 185°F)

**Protection**
IP65, 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**
18-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>PIN#</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>
1: 40-pin TE Deutsch P/N: DRC13-40PA
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>
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<tr>
<td>27</td>
<td>ANALOG OUTPUT 8</td>
</tr>
<tr>
<td>28</td>
<td>ANALOG OUTPUT 7</td>
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<tr>
<td>29</td>
<td>ANALOG OUTPUT 6</td>
</tr>
<tr>
<td>30</td>
<td>ANALOG OUTPUT 5</td>
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<tr>
<td>31</td>
<td>UNIVERSAL SIGNAL INPUT 1</td>
</tr>
<tr>
<td>32</td>
<td>UNIVERSAL SIGNAL INPUT 3</td>
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<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>
Mating Plug Kit AX070200

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 4B-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 rated for 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.
### Mounting

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.

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 of the module.

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).

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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: TDA/X030211-09/25/19