Four Inputs, Two Outputs Universal Valve Controller

2 Universal Signal Inputs, Magnetic Pick-Up Sensor, or Encoder Inputs
2-3A High Side, Low Side or Half-bridge Outputs
CAN (SAE J1939)
Programmable with the Axiomatic Electronic Assistant
and with Android and Apple iOS Devices

P/N: AX022420

Features:

- 2 universal signal inputs configurable as:
    - Voltage
    - Current
    - Resistive
    - PWM
    - Frequency/RPM
    - or Digital
- Magnetic Pick-Up Input
- Encoder Input
- 2 independent outputs to drive valves (0-3A) are user configurable as:
    - Proportional Current
    - Proportional Voltage
    - Hotshot Digital
    - PWM Duty Cycle (1 Hz to 25 kHz)
    - On/Off Digital
- Universal output type is user selectable as high side, low side or half bridge output.
- SAE J1939 CAN port
- 12Vdc or 24Vdc nominal
- One reference voltage (+5V) is available to power sensors.
- Operates from -40 to 85°C (-40 to 185°F).
- Two LED indicators
- IP20
- DIN rail mount
- CE marking
- Configurable via the Axiomatic Electronic Assistant**.**
- A Near Field Communications Antenna (NFC) is provided. E-Write NFC application for Android and Apple iOS devices can be used to configure the device.

Applications:

The controller is designed to meet the rugged demands of mobile equipment, marine and heavy-duty industrial machine applications. These applications include, but are not limited to:

- **Proportional Fan Drive Control**
- PID Closed Loop Valve Control, Hydraulic Valve Control
- Signal Conversion

Ordering Part Numbers:

Dual Input, Two Outputs Valve Controller, 250 kbps SAE J1939: **AX022420**
Dual Input, Two Outputs Valve Controller, 500 kbps SAE J1939: **AX022420-01**
Dual Input, Two Outputs Valve Controller, 1 Mbps SAE J1939: **AX022420-02**

Accessories:
Axiomatic Electronic Assistant Configuration KIT, P/Ns**: AX070502** or **AX070506K**
E-Write NFC Application is available for Android and iOS devices (see User Interface below).

Description:

The Universal Valve Controller (4i2o) is designed for extremely versatile control of up to two proportional outputs to directly drive coils or other loads. Its flexible circuit design gives the user a wide range of configurable input or output types. The sophisticated control algorithms allow the user to program the controller for a wide range of applications without the need for custom software.

The controller has two fully programmable universal inputs that can be setup to read: voltage, current, resistive, frequency, or digital input signals. There are also two universal outputs that can be setup to drive: proportional current (up to 3A each); hotshot digital current; proportional voltage (up to supply); proportional PWM; or straight on/off digital loads. The universal output type is user selectable as high side, low side or half bridge output. All I/O ports on the unit are independent from one another.

The 4i2o is a highly programmable controller, allowing the user to configure it for their application. Its sophisticated control algorithms allow for open or closed loop drive of the proportional outputs. It can be operated as either a self-contained control system, driving the outputs directly from the on-board inputs, and/or it can be integrated into a CAN J1939 network of controllers. All I/O and logical function blocks on the unit are inherently independent from one another but can be programmed to interact in many ways.

The 4i2o has several built-in protections that can shut off the outputs in adverse conditions. They include hardware shutoffs to protect the circuits from being damaged as well as software shutdown features that can be enabled in safety critical systems.

All setpoints are user configurable using the Axiomatic Electronic Assistant.

A rugged power supply interface accepts 12 Vdc or 24 Vdc nominal for battery powered machine applications. LED's indicate operational status. The enclosure is DIN rail mount. It operates from -40 to 85°C (-40 to 185°F). The sophisticated control algorithms allow the user to program the controller for a wide range of applications without the need for customer software.
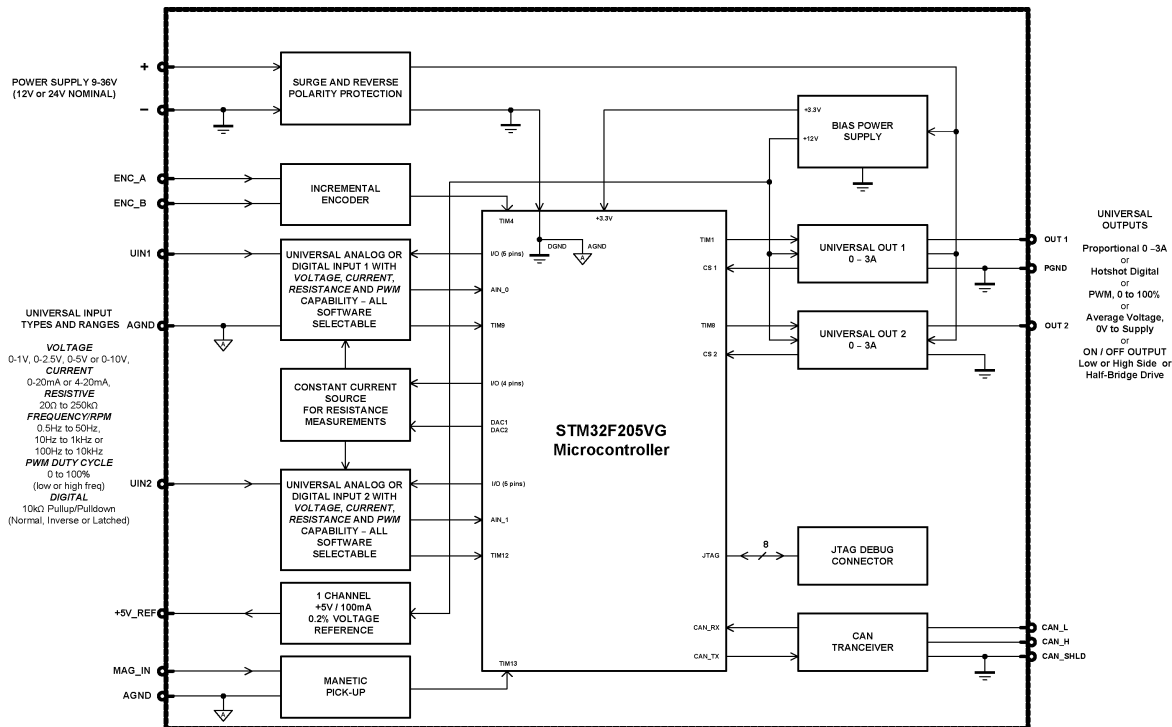

Figure 1 – Logical Functional Block Diagram

Technical Specifications:

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 https://www.axiomatic.com/service/.

Power Supply

Power Supply Input	12 Vdc or 24 Vdc nominal 8…36 Vdc power supply range Shutdown voltage is 6.0 Vdc.
Protection	Reverse polarity protection is provided. Surge protection up to 150V is provided. Overvoltage shutdown of the output load is provided at 41V. Undervoltage protection (hardware and software shutdown at 6V) is provided.

Inputs

Universal Signal Inputs	2 fully independent universal signal inputs are provided. All inputs are user selectable as Voltage, Current, Resistive, Frequency, RPM, PWM or Digital input types. Refer to Table 1.0. Inputs are sampled multiple times per millisecond. Protected against shorts to GND or +Vps (up to 43Vdc) All input channels can handle negative voltage inputs down to -2VDC due to voltage spikes or noise. Response time to change at the input 2 mSec +/- 1 mSec (without software filtering) unless otherwise noted.
Voltage Reference	1 +5VDC, +/- 0.5%, 100mA maximum
Analog GND Reference	One provided
Magnetic Pick Up Sensor Input	Range: 0.5 Hz to 20 kHz Amplitude: 100 mV to 60 Vrms
Encoder Input	One 2 phase, phase A and B, incremental encoder input. Range: 0.5 Hz to 150 kHz Amplitude: up to +Vsupply

Table 1.0 – **Input – User Selectable Options**	
Analog Input Functions	Voltage Input, Current Input or Resistive Input 12-bit Analog to Digital
Voltage Input	0-2.5V (Impedance 1 MΩ) 0-5V (Impedance 200 kΩ) 0-10V (Impedance 135 kΩ) 1mV resolution, accuracy +/- 1% error
Current Input	0-20 mA (Current Sense Resistor 124 Ω) 4-20 mA (Current Sense Resistor 124 Ω) 1uA resolution, accuracy +/- 1% error
Resistive Input	Self-calibrating for range of 20 Ω to 250 kΩ with Auto Ranging 1Ω resolution, accuracy +/- 1% error
Digital Input Functions	Discrete Input, PWM Input, Frequency Input, RPM Input 15-bit timer (PWM, Frequency, RPM)
Digital Input Level	5V CMOS, +Vps (12V, 24V)
PWM Input	0 to 100% Low Frequency (<1kHz) or High Frequency (>100 Hz) 0.01% resolution, accuracy +/- 1% error 1MΩ Impedance, or 10kΩ Pullup/Pulldown *Response time is dependent on input frequency.*
Frequency/RPM Input	0.5 to 50Hz Range: 0.20Hz resolution 10Hz to 1kHz Range: 2.0Hz resolution 100 Hz to 20kHz Range: 70Hz resolution Accuracy +/- 1% error 1 MΩ Impedance, or 10 kΩ Pullup/Pulldown *Response time is dependent on input frequency.*
Digital Input	Configurable Active High with 10kΩ pullup or Active Low with pulldown resistor (to GND) resistor which can also be disabled (floating input) Normal, Inverse or Latched (pushbutton) Rising edge ON threshold 3.7V +/- 0.1V Falling edge OFF threshold 2.9V +/- 0.1V Input debouncing is selectable, will slow response time

Outputs

Universal Outputs	Two independent universal outputs selectable as: proportional current, proportional voltage, hotshot or ON/OFF digital or PWM type. Universal output type is user selectable as high side, low side or half bridge output. Up to 3A sourcing (high-side and half-bridge mode) or up to -3A sinking (low-side mode) All output types have configurable minimum and maximum output levels within the range for the type selected. Current Outputs: 1mA resolution, accuracy +/- 1% error Software controlled PID current Range 0 to 3000 mA Fully configurable dither superimposed on top of output current Configurable amplitude and frequency range from 50 to 400Hz High frequency output drive at 25kHz (default) *Note: Both outputs use the same dither frequency.* *Outputs can be independently configured for high frequency output.* Voltage Outputs: 0.1V resolution, accuracy +/- 5% error Average voltage output based on unit power supply High frequency drive at 25kHz Additional external filtering is required to create a DC voltage PWM Outputs: 0.1% resolution, accuracy +/- 1% error Range 0 to 100% Output Frequency: 1 Hz to 25 kHz Configurable frequency ONLY if no current output types are used, otherwise default 25kHz is used Outputs can be linked in this mode to provide mirrored output signals. Digital On/Off: Sourcing from power supply, sinking from output to ground or off. Load at supply voltage must not draw more than 4A.
Response Time	10 msec.
Protection	Fully protected against short circuit to ground or +Vps Grounded short circuit protection will engage at 4.5A +/- 0.5A. Unit will fail safe in the case of a short-circuit condition and self-recovers when the short is removed.
Power GND Reference	Two are provided.

General Specifications

Microcontroller	STM32F205VGT7 32-bit, 1MByte flash memory
Quiescent Current	80 mA @ 12Vdc, 50 mA @ 24Vdc typical
LED Indicators	2 bicolour LED's (Red and Green) Power, heartbeat, input fault indication and output fault indication
CAN Communications	1 Isolated CAN port (SAE J1939) (CANopen® on request) Models: AX022420 – 250 kbps baud rate AX022420-01 – 500 kbps baud rate AX022420-02 – 1 Mbps baud rate
Control Logic	User programmable functionality using the Axiomatic Electronic Assistant service tool. Refer to the User Manual for details.
CAN Communications	Compliant to SAE CAN J1939 Standard 1 CAN port (SAE J1939)
NFC Communications	Near Field Communication Full-duplex Data rate: 106 kbit/s Complies with ISO1443 (RF protocol), ISO13239, and ISO7816 Protected and secure configuration
User Interface	Axiomatic Electronic Assistant P/N: **AX070502** or **AX070506K**. E-WRITE NFC Application is available for a fee from Google Play for Android devices (https://play.google.com/store/apps/details?id=com.axiomatic.ewritenfc). E-WRITE NFC Application can be downloaded for a fee from Apple's App Store for iOS devices (https://apps.apple.com/us/app/e-write-nfc/id6473560354).
Software Reflashing	Via the Axiomatic Electronic Assistant P/N: **AX070502** or **AX070506K**

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CAN Response Time	Per the J1939 standard, the maximum recommended transmit rate for any message is 10ms. Response time of feedback on the CAN to changes at the I/O will be a combination of the I/O type's response time and the configurable software filtering, ramps, delays, etc. that were selected in the application.
Compliance	CE / UKCA marking
Protection	IP20
Weight	0.30 lb. (0.136 kg)
Temperature Rating	Operating: -40 to 85°C (-40 to 185°F) Storage: -50 to 105°C (-58 to 221°F)
Enclosure and Dimensions	Phoenix Contact: ME MAX 22,5 G 2-2 KMGY – 2713638 or PHO ME MAX 22.5 2-2 KMGY – 2713625 (vented) Polyamide, UL94V0, cULus recognized, China RoHS DIN rail TH 35-7.5 99 x 114.5 x 22.5 x 99 mm (L x H x W x D) Refer to Figure 2.0.
Electrical Connections	4 Phoenix Contact PSPT 2,5/ 4-ST KMGY spring clamp connectors Accepts 24-14 AWG wire. Refer to Table 2.0 and Figure 2.0. for pin out.
Installation	DIN rail mount, TH 35-7.5
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.
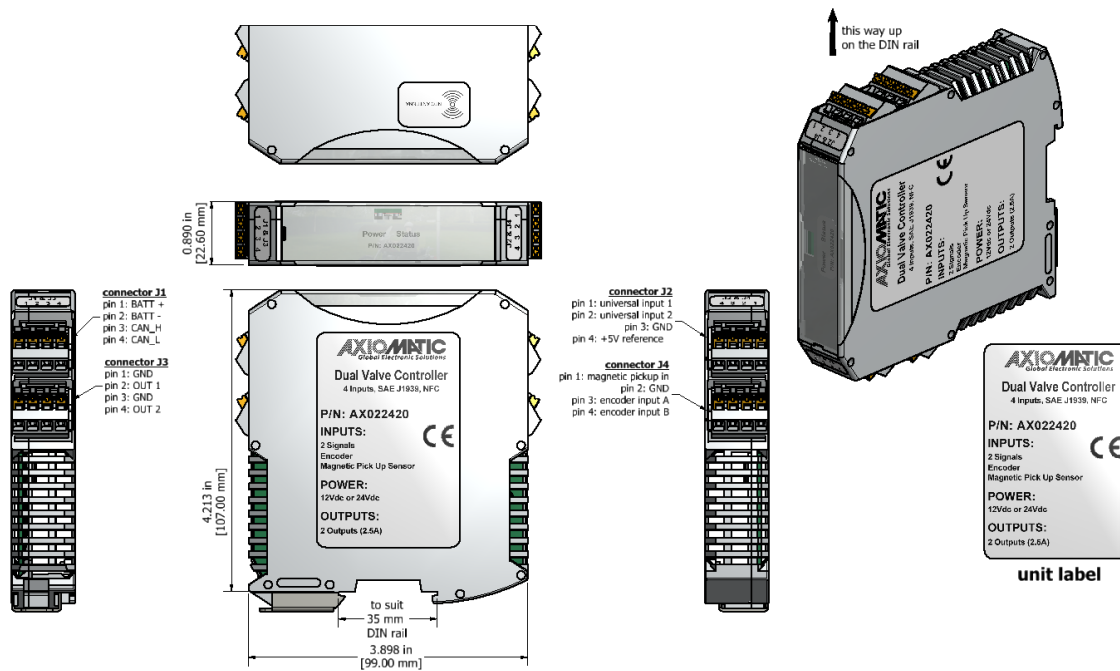
Figure 2 – Dimensional Drawing

Table 2.0 – Pin Out: AX022420

Power and CAN (J1)		Outputs (J3)		Inputs (J2)		Inputs (J4)	
PIN #	Function	PIN #	Function	PIN #	Function	PIN #	Function
1	BATT +	1	Output 1-	1	Universal Input 1	1	Magnetic Pick-Up Input
2	BATT –	2	Output 1+	2	Universal Input 2	2	Common Analog GND
3	CAN_H	3	Output 2-	3	Input GND	3	Encoder Input A
4	CAN_L	4	Output 2+	4	+5V Reference	4	Encoder Input B

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