understand

innovate

solve

since 1991

Axiomatic has designed and manufactured highly engineered, electronic control products for some of the world's most rugged machine applications.

Axiomatic controls read engine temperatures or convert data signals acting as smart devices in an engine CAN bus control network.

An Axiomatic I/O controller provides precise, repeatable outputs to perform work functions on a machine and optimizes equipment performance. Our controls can interface with automation signals, joysticks, pushbuttons, sensors, or other inputs and drive hydraulic valves, solenoids and actuators. As a CAN networked control, they are installed in various locations on the machine.

Axiomatic electronic controls integrate CANopen®, SAE J1939, SAE J1587, MilCAN, LIN, Modbus RTU, Ethernet, and other fieldbuses to facilitate control networking.

Remote access to machine controls via Bluetooth, Wi-Fi, or other technologies is part of the Axiomatic connectivity strategy.

Our inclinometers monitor machine position for heavy equipment operators to assist with job site productivity. Machine loads can be read over the CAN bus using Axiomatic technology.

Rugged Axiomatic power converters protect equipment electronics connected to battery power sources and provide a stable voltage supply with highly efficient operation.

Axiomatic's IP67-rated products are ideal for harsh environments. Vibration and shock testing is to military or customer standards. Specific environmental conditions are tested using SAE vehicle environmental standards or customer testing regimes. Our controls meet the requirements for electronics in engine applications for load

dump, engine cranking and other demanding electrical parameters.

Axiomatic products are tested by accredited laboratories to EMC standards for CE marking, as well as FCC requirements. All products are RoHS compliant. Type approved products are available for marine applications, while designs for machinery functional safety controls are also available.

Embedded firmware is developed using state-of-the-art coding tools. Simulink® which is a model-based design tool from Mathworks® is widely used in the design process. Axiomatic software designers maintain a library of Simulink building blocks for efficient design of new applications and products. In addition, the use of Simulink® allows the OEM machine designer to simulate their control system with the Axiomatic module included or design their own algorithms to run on Axiomatic hardware. This also permits fine tuning of the design parameters and testing of functionality prior to machine prototype installation.

The Axiomatic Electronic Assistant® tool for a PC simplifies user configuration and programming of input, output, CAN, math-based, programmable logic and diagnostic functional blocks in Axiomatic SAE J1939 controls. Our Visual and Scope tools monitor control performance.

Contact sales@axiomatic.com for an off-the-shelf control product. Contact support@axiomatic.com for technology set up assistance. Our design team is always available to discuss application-specific control solutions.

Marine & Stationary Engines   *Construction & Mining Equipment*

Agricultural Equipment   *Municipal & Transit Vehicles*   *On-Highway Vehicles*   *Gas & Oilfield Equipment*

Lift & Utility Equipment   *Industrial Automation*

Renewable Energy   *Electric & Hybrid Vehicles*   *Railway Equipment*

design to succeed

Axiomatic's design team works quickly to turn OEM requirements into effective electronic control products.

Collaboration
We work closely with our customers to understand their application requirements and to provide effective solutions.

Innovation in Controls Design
Axiomatic has over the years developed a wide range of technology building blocks leading to control, power conversion and motor drive solutions. A commitment to continuous R&D for circuit and product development leads to innovation, energy efficiency and cost-effective technology. We utilize the latest industry standards and tools for design.

New Product Introduction Process
Our New Product Introduction (NPI) process is rigorous. Both hardware and software are managed via a controlled NPI process with gateways. Engineering product development uses a data analysis based approach. Engineering design capabilities include: electronics schematic design; multi-layer circuit board layout design; 3D mechanical design; thermal modelling; MTBF analyses; product validation; as well as software design and modelling. Product housings can be prototyped using our 3D printer for evaluation during the prototype phase. All controls are evaluated for manufacturability during the design process. Third party testing is available for CE marking (EMC), type approvals, UL/CSA or equivalent recognitions and more. Axiomatic responds to customer based planning and part approval processes such as APQP, ISIR, and PPAP.

Quality Manufacturing
Axiomatic prototype and production-ready controls are manufactured in-house at our ISO 9001 facility in Mississauga, Ontario, Canada. We utilize a modern ERP system and rely on supply chain management processes. Product traceability is an important feature of our lean manufacturing process. Axiomatic controls ship worldwide to meet customer just-in-time supply programs.

DESIGN STAGES

PROTOTYPE

PRE-PRODUCTION

PRODUCTION
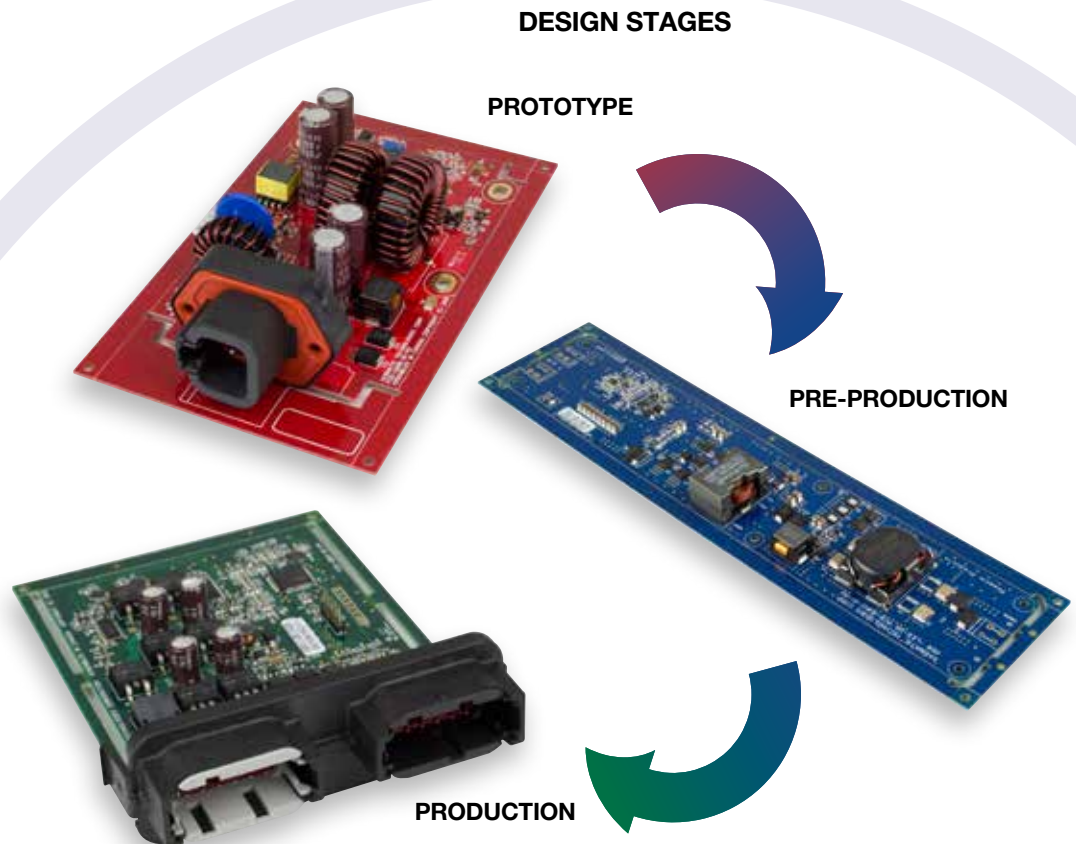
electronic controls

extend engine control system networks

Axiomatic **Engine Control System Components** provide rugged, reliable electronic control solutions for a variety of stationary and mobile engine control automation applications. Engine temperatures from embedded thermocouples or RTD's are transmitted over the CAN bus to communicate to an engine control unit (ECU). Some products are suited for hazardous location ratings and carry marine type approvals for steel ships or offshore platforms.

I/O modules extend engine control systems. Axiomatic offers CAN/PWM controls. Analog, digital, sensor and other inputs as well as interface with the CAN bus are available. CAN based modules also provide alarm, relay, and interlock outputs.

Axiomatic **Protocol Converters and CAN Gateways** offer a solution for data transfer and integration between legacy and standard control systems. CAN bus (SAE J1939, CANopen), SAE J1587, LIN, Ethernet, and Modbus RTU are some of the supported protocols.

Data Signal Converters interface, condition and distribute critical current, voltage, resistive, frequency, PWM or digital control signals. Signal isolation protects measurement and control signals as well as sensitive controls from the effects of noise, power surges, and other hazards present in industrial data acquisition and battery-powered machine or engine environments. The modules are designed to mount on a DIN rail for easy installation in a control panel. Models with single or multiple channels feature user configurability and a CAN bus option.

Other specialty signal converter products are available such as an **LVDT Simulator** for use in turbine test platforms.

**ENGINE CONTROL
SYSTEM COMPONENTS**

Thermocouple & Analog
Inputs/CAN Controller

20 Channel
Thermocouple/CAN Module

I/O MODULES

**PROTOCOL CONVERTERS
AND CAN GATEWAYS**

SAE J1939/SAE
J1939/Modbus RTU
Gateway

CAN/PWM Converter

CAN/4 Analog Signal
Outputs Controller

DATA SIGNAL CONVERTERS

4-20 mA/PWM
Signal Converter,
DIN rail mount

**LVDT
SIMULATOR**

Isolated Dual Channel Signal
Converter with CAN

input/output (I/O) controllers

optimize machine efficiency and performance

Axiomatic controls communicate over the **Controller Area Network (CAN)**. They support the CAN 2.0B physical layer and utilize higher level protocols such as SAE J1939 or CiA CANopen®. Other protocols are available on request.

Analog, Digital and PWM Signal **I/O modules** with CAN bus communications reduce field wiring costs while establishing an economical, manageable approach for control system expansion and repair.

Real-time control with diagnostic information is invaluable in modern equipment design. Axiomatic offers advanced **electronic controls to drive hydraulic valves, servo valves, solenoids and actuators**. Our valve drivers have a long operating history on mobile equipment and in industrial motion control systems. Flexible user programmability and a wide selection of standard control profiles for precise, reliable control are included in a variety of available I/O configurations.

Signal Converters with CAN bus can command electrohydraulic valves from the machine network.

An Axiomatic **Fan Controller** is integrated into a machine's hydraulic fan drive system. Variable control of the rotational speed of a fan-drive motor provides maximum efficiency and noise control for operation of the engine cooling fan system.

The end user can easily configure or program functional blocks, reflash firmware and monitor Axiomatic SAE J1939 controls using the PC-based **Axiomatic Electronic Assistant®**, Visual and Scope tools.

CAN-based sensors can be integrated into machine control systems.

Axiomatic controls are available with standard embedded software or can be modified for application-specific applications.

ELECTRONIC CONTROLS TO DRIVE HYDRAULIC VALVES, SERVO VALVES, SOLENOIDS AND ACTUATORS

CAN/1 Output Valve Controller

12 Inputs/12 Outputs Valve Controller, SAE J1939

CAN/2 Outputs Valve Controller

Plug-In CAN/2 Outputs Valve Controller

I/O MODULES

FAN CONTROLLER

10 Universal Signal Input/ CAN I/O Controller

Fan Controller rated for 125°C

connectivity

technology transfers data remotely

Axiomatic technology supports customer connectivity platforms.
- **Communicate via mobile phone applications for set up and diagnostics**
- **Diagnose, control and data link remotely**
- **Interface and exchange data between different equipment protocols**
- **Bridge a CAN bus device to the Internet**

The Axiomatic **CAN/Bluetooth Converter** permits fast wireless transfer of data via Bluetooth for real time display of information. An Axiomatic **CAN/Wi-Fi Converter** offers multiple functions by enabling CAN networked devices to easily connect and display data on computers, tablets or smartphones.

Our **CAN/Ethernet Converter** provides a two-way interface between devices on the CAN and Ethernet IP networks. It can be used for various tasks including CAN bus monitoring, device configuration and firmware updates on the machine or over the Internet. The converters can be used as CAN bus extenders and baud rate converters without any additional programming.

An **Ethernet Switch** connects multiple Ethernet based devices on a machine.

The **CAN Protocol Converter** is a smart gateway between different machine control protocols such as SAE J1939, CANopen, SAE J1587 and Modbus RTU. The **LIN/CAN Converter** links LIN devices to the machine's CAN network. A Power Line Communications (SAE J2497) to SAE J1939 CAN Converter is also available.

Remote configuration of an Axiomatic I/O module is simple with **Near Field Communication (NFC) Technology.**

Discuss with Axiomatic your application requirements for **internet and cloud-based solutions**. Remote customer access to machine controls and other information sharing solutions are available.

CAN/BLUETOOTH CONVERTER

CAN/ETHERNET CONVERTER

ETHERNET SWITCH

LIN/CAN CONVERTER

CAN PROTOCOL CONVERTER
SAE J1939/ CANopen/Modbus RTU Gateway

machine controls

measure machine position, angle, rotation, acceleration and load

Axiomatic **Inclinometers** transmit pitch and roll angles over CAN bus. They can also provide gravity angle and unit acceleration information. Axiomatic uses 3 axis MEMS and gyroscope technology for maximum position control. Rotary motion in a machine is monitored with the **Resolver Signal Conditioner**.

The **4-Channel Strain Gauge CAN Controller** accepts up to four 4-wire strain gauge connections with an interface to the machine CAN fieldbus.

INCLINOMETERS

RESOLVER SIGNAL CONDITIONERS

4-CHANNEL STRAIN GAUGE CAN CONTROLLER

Triaxial Inclinometer

Triaxial Inclinometer with Gyroscope

power electronics

improve system reliability

Axiomatic **DC/DC Converters** provide a stable supply voltage when installed after 110Vdc, 96Vdc, 72Vdc, 48Vdc, 24Vdc, or 12Vdc batteries in vehicle, generator set or railway applications. Battery taps are avoided and sensitive equipment is protected. Step up and step down power converters convert 12Vdc or 24Vdc battery power into 120Vdc, 48Vdc, 24Vdc, or 12Vdc and vice versa for other electronic devices. Converters may be installed in parallel for redundancy or to increase the output.

Our **Power Management Systems** include controls for a diverse set of applications. LED drivers are integrated into mining equipment lighting systems. A power distribution unit integrates with other Axiomatic I/O in a fuel cell stack. A Wake-On-Charge module manages electric vehicle power modes for wake and sleep.

Motor Controllers for variable speed DC, BLDC, Permanent Magnet Synchronous, and Stepper Motors offer accurate speed and torque for better control over machine performance. The energy efficient controllers provide flexible motor drive while permitting CAN system integration. They are designed for harsh environments with rugged packaging and environmental performance.

A variety of **Surge Suppressors** protect against transient voltages and surges for all sensitive electronic equipment. As protection devices, they are designed with multiples stages to handle large current surges and voltage spikes. Modules are designed for DIN rail mounting in a control panel.

Smart **Battery Chargers** provide rugged, reliable solutions for a variety of stationary engine and vehicle applications. From multi-stage and efficient charging, distributed I/O functionality, CAN system integration, managed heat dissipation to inherent power factor correction, Axiomatic offers advanced electronics for smart charging applications.

DC/DC CONVERTERS

Isolated 24Vdc/24Vdc Power Converter

48Vdc/24Vdc Power Converter

24Vdc/120Vdc Power Converter, 230W, DIN rail Mount

MOTOR CONTROLLERS
25A Bi-directional DC Motor Controller

SURGE SUPPRESSORS
110Vdc, 10A Surge Suppressor

POWER MANAGEMENT SYSTEMS
Wake-On-Charge Module

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