

## Thermocouple Scanner

*20 Thermocouple Channels*

*CAN, SAE J1939*

*with the Axiomatic Electronic Assistant*

**P/N: AX185000**

### Description:

The Thermocouple Scanner monitors up to 20 thermocouples and provides the temperature information to the engine control system over SAE J1939 CAN bus. The controller features auto-baud-rate detection for the CAN communications. The input channels are independently configurable as Type J, K, B, E, N, R, S or T thermocouples. Temperature information can include exhaust temperature and fluid temperature monitoring. All 20 channels of temperature data are automatically sent over the CAN bus when power is applied with no additional programming or configuration required. Integral diagnostics determine thermocouple integrity. All inputs are fully isolated from the CAN line, and from the power supply. During set-up, using a USB-CAN converter and a PC, the operator can configure the controller via the Axiomatic Electronic Assistant to suit a wide variety of applications. Settings are saved to non-volatile memory upon command.



The Thermocouple Scanner features rugged packaging and connectors, which are TE Deutsch equivalents, for an IP67 rating.

### Applications:

Control systems for industrial and marine power generator sets (stationary or portable)

### Ordering Part Number:

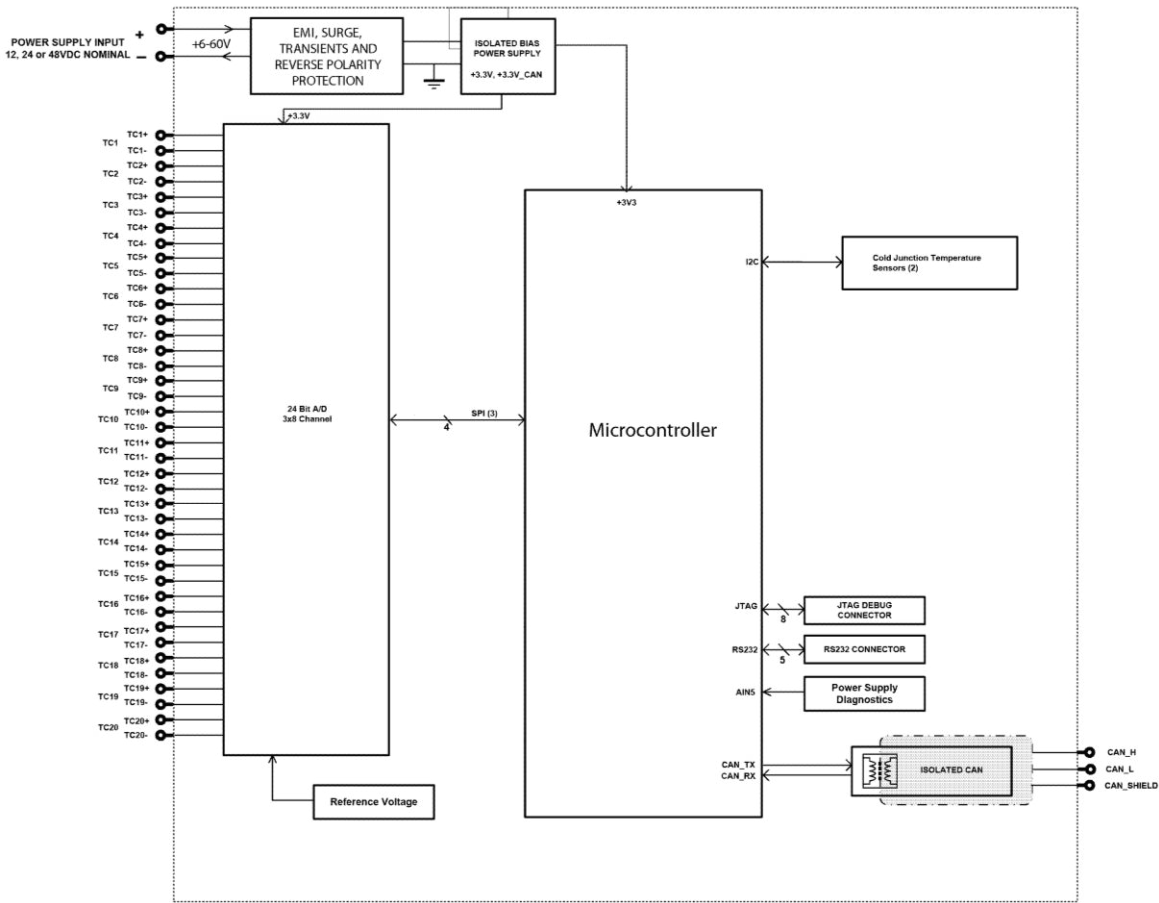
20 Channel Thermocouple Module, SAE J1939 with auto-baud-rate detection P/N: **AX185000**  
 20 Channel Thermocouple Module, CANopen® P/N: **AX185001**

#### Accessories:

Mating Plug KIT P/N: **AX070200**

Axiomatic Electronic Assistant Configuration KIT, P/Ns: **AX070502**, **AX070505K**, or **AX070506K**

# 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/>.

### Input

Power Supply Input	12 or 24 VDC nominal (9 to 60 VDC power supply range)
Quiescent Current	40 mA @ 12 VDC; 20 mA @ 24 VDC typical
Protection	Reverse polarity protection is provided. Power supply input section protects against transient surges and short circuits and is isolated from thermocouple inputs
Thermocouple Types	Up to 20 channels, independently configurable for B, E, J, K, N, R, S, or T

Thermocouple Inputs	<p>The device reads voltage (mV) signals from the supported Thermocouple types.</p> <p>B = 0 to 13.82 mV  E = -9.835 to 76.373 mV  J = -8.095 to 69.553 mV  K = -6.458 to 54.886 mV  N = -4.345 to 47.513 mV  R = -0.226 to 21.101 mV  S = -0.236 to 18.693 mV  T = -6.258 to 20.872 mV</p> <p>Temperatures are configured to indicate the SAE J1939 SPN to be transmitted by that temperature input.</p> <p>Resolution: 0.001°C</p> <p>Accuracy:</p> <ul style="list-style-type: none"> <li>• <math>\pm 1^{\circ}\text{C}</math> typical with cold junction compensation at ambient temperature (except types J, E, K, N)</li> <li>• Type J: <math>\pm 1^{\circ}\text{C}</math> up to <math>600^{\circ}\text{C}</math> and <math>\pm 3^{\circ}\text{C}</math> beyond <math>600^{\circ}\text{C}</math> (typical with cold junction compensation)</li> <li>• Type E: <math>\pm 1^{\circ}\text{C}</math> up to <math>450^{\circ}\text{C}</math> and <math>\pm 3^{\circ}\text{C}</math> beyond <math>450^{\circ}\text{C}</math> (typical with cold junction compensation)</li> <li>• Type K: <math>\pm 1^{\circ}\text{C}</math> up to <math>850^{\circ}\text{C}</math> and <math>\pm 3^{\circ}\text{C}</math> beyond <math>850^{\circ}\text{C}</math> (typical with cold junction compensation)</li> <li>• Type N: <math>\pm 1^{\circ}\text{C}</math> up to <math>950^{\circ}\text{C}</math> and <math>\pm 3^{\circ}\text{C}</math> beyond <math>950^{\circ}\text{C}</math> (typical with cold junction compensation)</li> </ul>
Scan Rate	Maximum sweep time: 1.5 seconds
Common Mode Readings	<p>Input range: <math>\pm 2.5\text{ V}</math> maximum</p> <p>Rejection: 120 db (maximum) at 2.5 Vp-p (50-60 Hz)</p>
Thermal Drift	4 ppm/°C of span (maximum)
Isolation	<p>Digital isolation is 500 VDC from input to ground.</p> <p>Three-way isolation is provided for the CAN line, inputs, and power supply.</p>
SPNs and PGNs	<p>The SPN drop list includes all temperature SPNs from the J1939-71 standard published up to January of 2009. If an SPN is not supported by the drop list, the user can select a zero SPN, which then allows them to define the SPN and PGN per the application requirements.</p> <p>One-byte parameters have a resolution of 1C / bit and a range of <math>-40^{\circ}\text{C}</math> to <math>210^{\circ}\text{C}</math>. Two-byte parameters have resolution of 0.03125°C / bit and a range of <math>-273^{\circ}\text{C}</math> to <math>1735^{\circ}\text{C}</math> (per SAE J1939).</p> <p>The Parameter Group Number (PGN) that will be used to send a temperature to the J1939 network will be entirely dependent on the Suspect Parameter Number (SPN) that was selected for that channel. In all cases, the PGN is a PDU2 type.</p> <p>Each PGN has a predefined priority and repetition rate associate with it.</p>
Averaging	The average temperature of all the active channels can be broadcasted to the network using the default "Engine Average Information" PGN, or on a Proprietary B message.
Protection	<p>Open circuit detection</p> <p>Frozen data detection</p> <p>Over or under temperature detection</p> <p>High temperature shutdown detection</p>

## Communication

CAN	<p>1 CAN port (2.0B, SAE J1939)</p> <p>250 kbit/s, 500 kbit/s, 667 kbit/s, 1 Mbit/s auto-baud-rate detection</p> <p>Digital isolation is provided for the CAN line.</p>
Network Termination	<p>According to the CAN standard, it is necessary to terminate the network with external termination resistors. The resistors are 120 <math>\Omega</math>, 0.25 W minimum, metal film or similar type. They should be placed between CAN_H and CAN_L terminals at both ends of the network.</p>

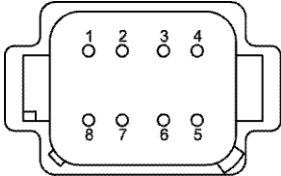
## General Specifications

Microcontroller	STM32F205VG, 32-bit, 1 MB flash memory
Control Logic	<p>User programmable functionality with the Axiomatic Electronic Assistant (EA)</p> <ul style="list-style-type: none"> <li>Node address is auto configurable as per J1939-81 and/or via customer configuration.</li> <li>Monitored parameters and diagnostics are user selectable from a drop-down list in the EA.</li> <li>Monitored parameters and diagnostics are read-only over the network.</li> <li>Units are pre-configured with default values at the factory. Refer to the user manual.</li> <li>All parameter locations have default values that do not conflict.</li> <li>Module is fully functional during configuration and communications.</li> <li>Parameter values and diagnostic error codes are retained when the modules are de-energized.</li> <li>Easily selectable SPNs from a drop-down list of the temperature SPNs supported by SAE J1939.</li> <li>User defined SPN and PGN's configurable with EA to suit the application.</li> <li>Configurable ECU Instance in the NAME to allow for multiple ECU's on the same network</li> </ul>
SAE J1939 Profile	<p>For J1939 compliance (SAE, Recommended Practice for a Serial Control and Communications Vehicle Network, October 2007), all modules comply with the applicable portions of the following.</p> <ul style="list-style-type: none"> <li>SAE J1939-21, Dec 2006, Data Link Layer</li> <li>SAE J1939-71, Sep 2013, Application Layer</li> <li>SAE J1939-73, Feb 2010, Application Layer – Diagnostics</li> <li>SAE J1939-81, March 2017, Network Management</li> </ul> <p><i>Customer specific proprietary extensions can also be included in the SAE J1939 profile on request.</i></p>
Diagnostics	<p>Configurable Diagnostic Messaging parameters</p> <p>Diagnostic Log is maintained in non-volatile memory.</p> <p>Each thermocouple channel could be configured to send diagnostic messages to the network if the temperature goes out of range.</p> <p>When sending an "Active Diagnostic Trouble Code" (DM1) or a "Previously Active Diagnostic Trouble Codes" (DM2) message, the controller will use the appropriate Diagnostic Trouble Code (DTC). As defined by the standard, this is a combination of the Suspect Parameter Number (SPN), the Failure Mode Indicator (FMI), Occurrence Count (OC) and the SPN Conversion Method (CM).</p>
User Interface	<p>Axiomatic Electronic Assistant, P/Ns: <b>AX070502</b>, <b>AX070505K</b>, or <b>AX070506K</b></p> <p>Updates for the EA are found on <a href="http://www.axiomatic.com">www.axiomatic.com</a></p>
UL and cUL Compliance	Standard for Controllers for Use in Power Production, CAN/ULC 6200, 1st edition
CSA/UL	<p>CAN/CSA-C22.2 No. 61010-1-12 + AMD1-18</p> <p>UL Std. No. 61010-1 (3rd Edition) + AMD1:2018</p>
CSA Hazardous Locations	<p>CSA Approval Ex ec IIC T4 Gc Class I, Zone 2, A Ex ec IICT4 Gc Class I, Division 2, Groups A, B, C, D T4 Ta = -40°C to 70°C IP67</p> <p>Refer to Control Drawing in the User Manual UMAX185000, Appendix B.</p>
CE/ UKCA Compliance	<p>CE/ UKCA marking</p> <p>2004/108/EC (EMC Directive)</p> <p>2011/65/EU (RoHS Directive)</p> <p>2014/34/EU (Potentially Explosive Atmospheres Directive) under Sira Certificate 15ATEX4138X Issue 4</p>
Marine Type Approvals	ABS, CCS, LR, RINA
Vibration	7.32 Grms (random)
Operating Temperature	<p>-40°C to 85°C (-40°F to 185°F)</p> <p>(Note: For CSA hazardous location applications, the rating is -40°C to 70°C)</p>
Storage Temperature	-50°C to 120°C (-58°F to 248°F)
Humidity	Protected against 95% humidity non-condensing, 30°C to 60°C
Weight	2.2 lbs. (1 kg)
Protection	IP67
Enclosure and Dimensions	<p>Rugged aluminum housing, stainless steel end plates, neoprene gaskets</p> <p>5.87 in x 5.7 in x 2.87 in (149 mm x 146 mm x 73 mm)</p>

Electrical Connections

Power and CAN:

1 8-pin TE Deutsch equivalent connector, P/N: DT13-08PA

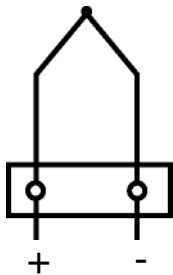


Pin #	Function
1	Power+
2	CAN_H
3	CAN_L
4	Power -
5	SHIELD
6	Not Used
7	Not Used
8	Not Used

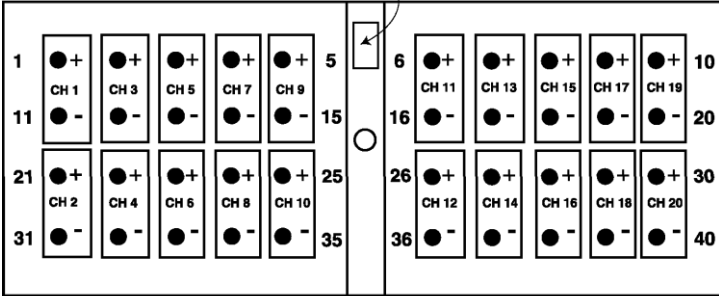
Thermocouples:

Type J, K, B, E, N, R, S, or T

1 40-pin TE Deutsch equivalent connector, P/N: DRC13-40PA



POLARIZING KEY



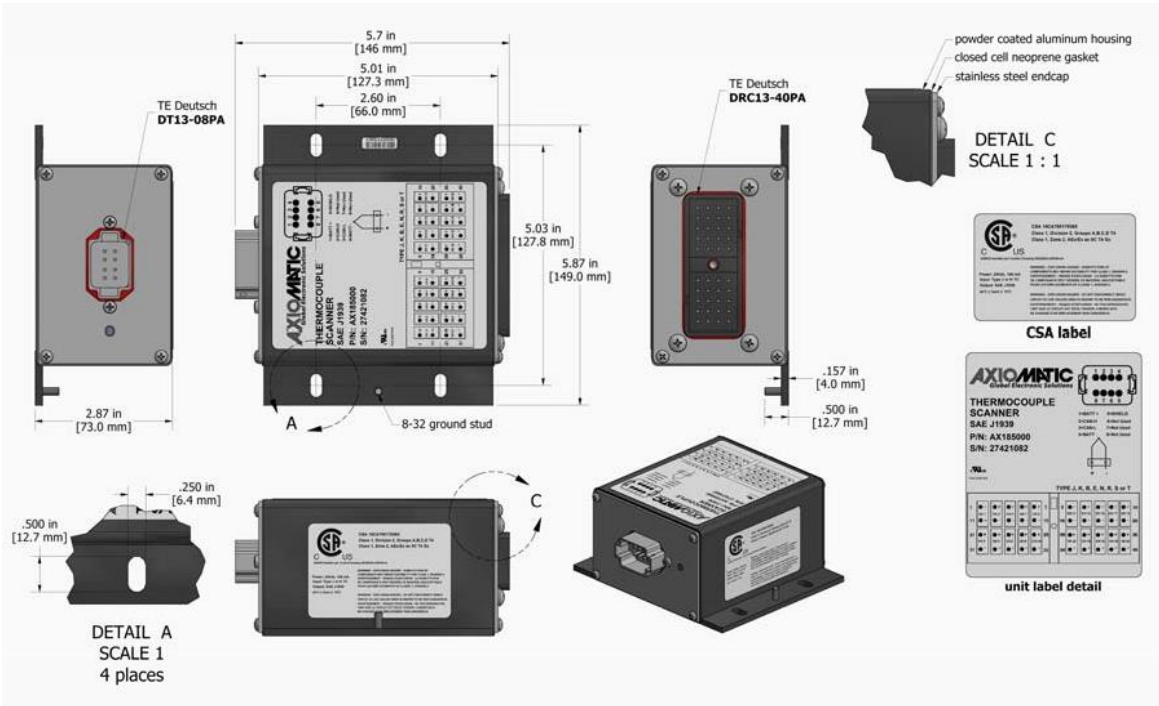
FRONT VIEW OF  
MODULE MOUNTED CONNECTOR  
DEUTSCH P/N: DRC13-40PA

TDAX185000

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Mating Connectors	<p>Mating Plug KIT P/N: AX070200 (This kit includes 1 plug DT06-08SA, 1 plug DRC16-40S, 1 wedgelock W8S, 48 contact sockets 0462-201-16141, and 24 sealing plugs 114017.) These items are also available from a local TE Deutsch distributor. A crimping tool from TE Deutsch is required to connect wiring to the sockets, P/N: HDT 48-00 or equivalent (not supplied).</p> <p><u>Power and CAN:</u> TE Deutsch equivalent connector, P/N: DT06-08SA, wedgelock W8S and sockets 0462-201-16141</p> <p><u>Thermocouples:</u> TE Deutsch equivalent connector, P/N: DRC16-40SE-A, or DRC18-40SA, or DRC16-40S with sockets 0462-201-16141</p>
Mounting	It can be mounted directly on the power generator set or remotely.

# Dimensional Drawing



Note: CANopen® is a registered community trademark of CAN in Automation e.V.

Form: TDAX185000-07/21/23