


TECHNICAL DATASHEET #TDAXTC4
Thermocouple Module, 4 Channel
P/N: AXTC4

Monitors 4 Type J, K or T Thermocouples
CAN (SAE J1939), RS-232
with Electronic Assistant® 


Description:

The Thermocouple Module monitors up to 4 channels of Type J, K or T thermocouples (others on request). The temperature information is provided to the engine control system over SAE J1939 CAN bus. Temperature information can include exhaust temperature, winding temperature, and fluid temperature monitoring. All channels are fully isolated and measure temperatures at the same time. Temperature data is automatically sent over the CAN bus when power is applied. During set-up, using an USB-CAN converter and a PC, the operator can configure the controller via the Axiomatic Electronic Assistant® to suit a wide variety of applications. Integral diagnostics can flag open wire fault detection. CAN communications are via an isolated CAN interface with SAE J1939 protocol. A RS-232 interface allows for quick user adjustments using Windows HyperTerminal or other similar terminal software. Settings are automatically saved to non-volatile memory.



Applications: Applications include power generator sets.

Features:

- Reads up to 4 Type J, K or T thermocouple inputs (other thermocouple types on request)
- All channels are measured simultaneously.
- Full channel to channel isolation and isolation from CAN line, other inputs and power supply
- Channels configured for SAE J1939 SPN to transmit the temperature measured by that input
- Cold junction compensation is provided.
- Thermocouple input resolution is 0.1 °C.
- Accuracy is +/-1 °C throughout the entire range of the thermocouple input.
- For J1939 compliance, all modules comply with the applicable portions of the following:
 - SAE J1939-21, April 2001, Data Link Layer
 - SAE J1939-71, November 2006, Application Layer
 - SAE J1939-73, September 2006, Application Layer – Diagnostic
 - SAE J1939-81, May 2003, Network Management
 - Customer specific proprietary extensions can also be included in the SAE J1939 profile.
- Robust 8...75VDC power supply, nominal 60V maximum, with reverse polarity protection
- Compact size for mounting directly on the power generator set or remotely
- Rugged IP67 rated packaging with plug-in connections
- Operational from -40 to 85°C (-40 to 185°F)
- RS-232 port for configuration and diagnostics
- **Electronic Assistant®**  runs on a Windows operating system for user configuration. An Axiomatic USB-CAN converter links the PC to the CAN bus.
- Configuration files can be saved and written to other AXTC4's during setup.

Ordering Part Numbers: AXTC4, Thermocouple Module, 4 Channels, SAE J1939

Accessories:

PL-DTM06-12SA-12SB Mating Plug Kit

(The KIT is comprised of: DTM06-12S, DTM06-12SB, 2 W12S and 24 contacts. The Axiomatic stock # is FG-IOCTRL-19.)

or AX070000 Mating plug kit with RS-232 connector

AX070502 Configuration KIT includes the following.

USB-CAN Converter P/N: AX070501

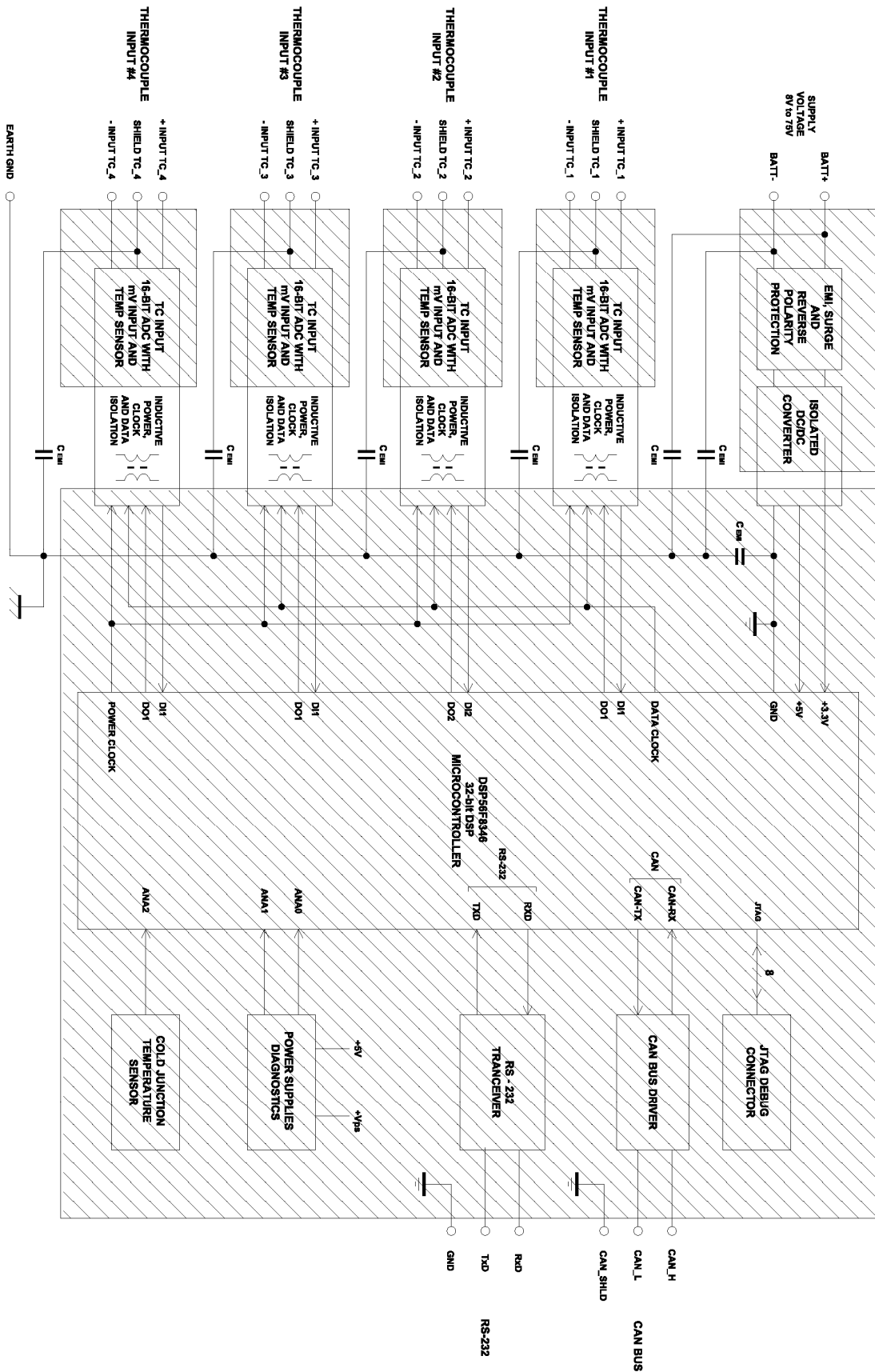
1 ft. (0.3 m) USB Cable P/N: CBL-USB-AB-MM-1.5

12 in. (30 cm) CAN Cable with female DB-9 P/N: CAB-AX070501

AX070502IN CD P/N: CD-AX070502, includes: **Electronic Assistant®** AX070500 software; EA & USB-CAN User

Manual UMAX07050X; USB-CAN drivers & documentation; CAN Assistant (Scope and Visual) software & documentation; and the SDK Software Development Kit.

NOTE: To order this kit, you need only to specify P/N: AX070502.



**Technical Specifications:
Input Specifications**

Power Supply Input	12, 24, 36, 42, 48, 60VDC nominal (8...75VDC power supply range) NB. The maximum total power consumption is <1.5 Watts.
Protection	Surge and reverse polarity protection are provided.
Isolation	Full isolation of each channel from the CAN line, other inputs and power supply. Isolation voltage is 1500 Vac (rms) or 2550V for 1 sec. for all channels to power and 50V (rms) for all channels to CAN interface.
All Inputs	4 Type J or K or T Thermocouple Modules (other types on request) All input channels are completely independent of each other and can read the thermocouple temperatures at the same time. Temperature is measured in °C with a 0.1°C resolution. All inputs send a message to the J1939 bus. There are 2 setpoints for each channel that are associated with the input and how the data is measured. Channels are configured to indicate the SAE J1939 SPN to transmit the temperature measured by that input. The Parameter Group Number (PGN) that will be used to send a temperature to the J1939 network is dependant on the Suspect Parameter Number (SPN) that was selected for that channel. Refer to Table 1.0 for a list of supported SPN's. Regardless of the SPN selected, temperature is always available for the associated PGN. <i>To use the J1939 capabilities, refer to the user manual for details.</i>
Measurement Rate	The measurement rate is 5 scans/Sec. All channels are measured simultaneously. The update rate is 200 mSec.
Common Mode	Common mode rejection is >110 db@ 5V p-p (programmable for either 50 or 60 Hz). Common mode input range is +/- 4 V minimum.
Resolution	Temperature data is measured with a resolution of 0.1 °C. When sending data to the J1939 bus, one byte parameters have a resolution of 1°C/ bit, an offset of -40°C and a range of -40 °C to 210 °C. Two byte parameters have resolution of 0.03125 °C / bit and a range of -273 °C to 1735 °C.
Drift	Overall drift with temperature is 50ppm/°C of span (maximum).
Accuracy	+/-1 °C throughout the entire range of the thermocouple input
Input Configuration	Refer to the user manual for details on configuration.
Shield	Four shield connections are provided.
Ground	Four analog ground connections are provided.

Table 1.0 - SPNs available for configuration of temperature inputs

SPN	Description
52	Engine Intercooler Temperature
75	Steering Axle Temperature
90	Power Takeoff Oil Temperature
105	Intake Manifold 1 Temperature
110	Engine Coolant Temperature
171	Ambient Air Temperature
172	Air Inlet Temperature
173	Exhaust Gas Temperature
174	Engine Fuel Temperature 1
175	Engine Oil Temperature 1
176	Turbo Oil Temperature
441	Auxiliary Temperature 1
442	Auxiliary Temperature 2
578	Drive Axle Temperature
1122	Alternator Bearing 1 Temperature
1123	Alternator Bearing 2 Temperature
1124	Alternator Winding 1 Temperature
1125	Alternator Winding 2 Temperature
1126	Alternator Winding 3 Temperature
1131	Intake Manifold 2 Temperature
1132	Intake Manifold 3 Temperature

1133	Intake Manifold 4 Temperature
1135	Engine Oil Temperature 2
1137	Exhaust Gas Port 1 Temperature
1138	Exhaust Gas Port 2 Temperature
1139	Exhaust Gas Port 3 Temperature
1140	Exhaust Gas Port 4 Temperature
1141	Exhaust Gas Port 5 Temperature
1142	Exhaust Gas Port 6 Temperature
1143	Exhaust Gas Port 7 Temperature
1144	Exhaust Gas Port 8 Temperature
1145	Exhaust Gas Port 9 Temperature
1146	Exhaust Gas Port 10 Temperature
1147	Exhaust Gas Port 11 Temperature
1148	Exhaust Gas Port 12 Temperature
1149	Exhaust Gas Port 13 Temperature
1150	Exhaust Gas Port 14 Temperature
1151	Exhaust Gas Port 15 Temperature
1152	Exhaust Gas Port 16 Temperature
1153	Exhaust Gas Port 17 Temperature
1154	Exhaust Gas Port 18 Temperature
1155	Exhaust Gas Port 19 Temperature
1156	Exhaust Gas Port 20 Temperature
1157	Main Bearing 1 Temperature (engine)
1158	Main Bearing 2 Temperature (engine)
1159	Main Bearing 3 Temperature (engine)
1160	Main Bearing 4 Temperature (engine)
1161	Main Bearing 5 Temperature (engine)
1162	Main Bearing 6 Temperature (engine)
1163	Main Bearing 7 Temperature (engine)
1164	Main Bearing 8 Temperature (engine)
1165	Main Bearing 9 Temperature (engine)
1166	Main Bearing 10 Temperature (engine)
1167	Main Bearing 11 Temperature (engine)
1172	Turbocharger 1 Compressor Inlet Temperature
1173	Turbocharger 2 Compressor Inlet Temperature
1174	Turbocharger 3 Compressor Inlet Temperature
1175	Turbocharger 4 Compressor Inlet Temperature
1180	Turbocharger 1 Turbine Inlet Temperature
1181	Turbocharger 2 Turbine Inlet Temperature
1182	Turbocharger 3 Turbine Inlet Temperature
1183	Turbocharger 4 Turbine Inlet Temperature
1184	Turbocharger 1 Turbine Outlet Temperature
1185	Turbocharger 2 Turbine Outlet Temperature
1186	Turbocharger 3 Turbine Outlet Temperature
1187	Turbocharger 4 Turbine Outlet Temperature
1212	Engine Auxiliary Coolant Temperature
1636	Engine Intake Manifold 1 Air Temperature (High Resolution)
1637	Engine Coolant Temperature (High Resolution)
1800	Battery 1 Temperature
1801	Battery 2 Temperature
1802	Intake Manifold 5 Temperature
1803	Intake Manifold 6 Temperature
2433	Right Manifold Exhaust Gas Temperature

2434	Left Manifold Exhaust Gas Temperature
2630	Engine Charge Air Cooler Outlet Temperature
2986	Engine Intake Valve Actuation System Oil Temperature
3241	Aftertreatment 1 Exhaust Gas Temperature 1
3242	Aftertreatment 1 Particulate Trap Intake Gas Temperature
3245	Aftertreatment 1 Exhaust Gas Temperature 3
3246	Aftertreatment 1 Particulate Trap Outlet Gas Temperature
3249	Aftertreatment 1 Exhaust Gas Temperature 2
3250	Aftertreatment 1 Particulate Trap Intermediate Gas Temperature
3275	Aftertreatment 2 Exhaust Gas Temperature 1
3276	Aftertreatment 2 Particulate Trap Intake Gas Temperature
3279	Aftertreatment 2 Exhaust Gas Temperature 3
3280	Aftertreatment 2 Particulate Trap Outlet Gas Temperature
3283	Aftertreatment 2 Exhaust Gas Temperature 2
3284	Aftertreatment 2 Particulate Trap Intermediate Gas Temperature
3468	Engine Fuel Temperature 2
3515	Catalyst Reagent Temperature 2
3823	Transmission Torque Converter Oil Outlet Temp
3831	Aftertreatment 1 Secondary Air Temperature
3834	Aftertreatment 2 Secondary Air Temperature
4076	Engine Coolant Temperature 2

General Specifications

Operating Conditions	-40 to 85°C (-40 to 185°F)
Weight	0.55 lbs. (0.25 kg)
Protection	IP67; Unit is conformal coated within the housing. Plugs carry an IP69 rating.
Microprocessor	Motorola DSP56F8346
Control Logic	Standard embedded software is provided. <i>Refer to the user manual for details.</i> (Application-specific control logic is available on request.)
RS-232 Port	The controller's RS232 port interfaces to a serial port (i.e. COM1) on a PC (115200 Baud Rate, N81, Xon/Xoff Flow Control). If the Axiomatic plug kit with a built-in RS-232 connector is not used, then the end user can make a RS-232 cable with the following pinout. Controller Grey Connector, Pin 2 -> TXD -> female DB-9 Pin 2 Controller Grey Connector, Pin 3 -> RXD -> female DB-9 Pin 3 Controller Grey Connector Pin 1 -> GND -> female DB-9 Pin 5
User Interface	Electronic Assistant® for <i>Windows</i> operating systems It comes with a royalty-free license for use. The Electronic Assistant requires an USB-CAN converter to link the device's (AXTC4) CAN port to a <i>Windows</i> -based PC for initial configuration. An Axiomatic USB-CAN Converter AX070501 is available. Order the EA and USB-CAN as a kit (P/N AX070502), which includes all interconnecting cables. Refer to Table 2.0 for details.
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 could be placed between CAN_H and CAN_L terminals at both ends of the network.

Table 2.0 - AX070500 Electronic Assistant and AX070501 USB-CAN

AX070502, Configuration KIT includes the following.
 USB-CAN Converter P/N: AX070501
 1 ft. (0.3 m) USB Cable P/N: CBL-USB-AB-MM-1.5
 12 in. (30 cm)CAN Cable with female DB-9 P/N: CAB-AX070501
 AX070502IN CD P/N: CD-AX070502, includes: Electronic Assistant® software; EA & USB-CAN User Manual UMAX07050X; USB-CAN drivers & documentation; CAN Assistant (Scope and Visual) software & documentation; and the Software Development Kit.
NOTE: To order this kit, you need only to specify P/N: AX070502.

Electronic Assistant®

The Electronic Assistant (EA) runs on any modern PC with the Microsoft Windows® 2000 operating system or higher. It comes with a royalty-free license for use.

System Requirements:
 Operating System: *Windows 2000* or higher including 64-bit editions
 Port: USB 1.1 or 2.0 full speed
 Display: VGA (XGA or better with 1024 x 768 recommended)
 Setup and Configuration:
 Refer to the User Manual UMAX07050X.

To order the EA software at the time of initial purchase, order the KIT AX070502 (see above) which includes the USB-CAN converter. For additional EA and USB-CAN software ONLY CD's, use ordering P/N: CD-AX070502.

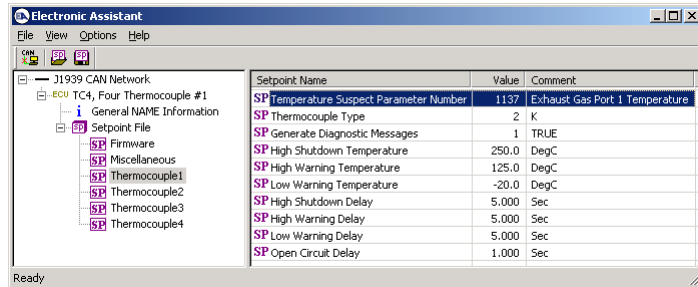
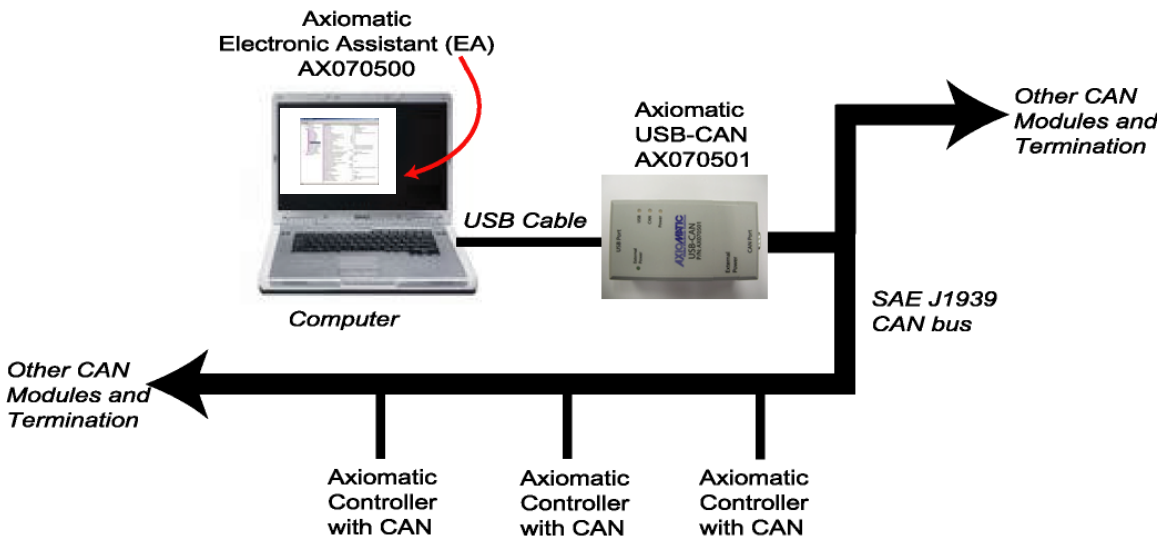


Figure 2.0 Configuration screen from the Electronic Assistant

The Electronic Assistant (EA) is a software configuration tool that runs on a PC connected to a J1939 bus via a USB to CAN converter, AX070501. Upon being connected to the bus, the EA will find all the Electronic Control Units (ECU) on the bus, and recognized those manufactured by Axiomatic. Using this tool, a user can quickly configure an Axiomatic ECU for the desired performance over a wide variety of applications.

Set up of AXTC4 on a CAN Network:



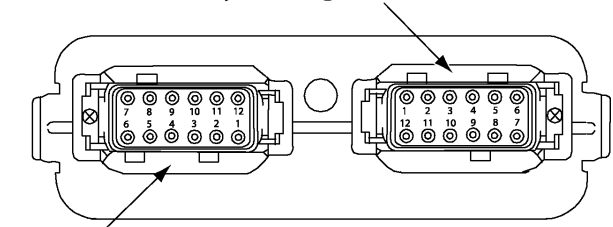
CAN Interface	<p>1 CAN port (SAE J1939) (CANopen® on request)</p> <p>The software was designed to provide flexibility and provides the following.</p> <ul style="list-style-type: none"> • Configurable ECU Instance in the NAME (for multiple ECU's on the network) • Configurable SPN for each channel • Configurable Diagnostic Messaging Parameters, as required • Diagnostic Log, maintained in non-volatile memory <p><i>Note: Configurable parameters are also called setpoints.</i></p> <p>The AXTC4 is compliant with Bosch CAN protocol specification, Rev.2.0, Part B, and the following J1939 standards. Refer to Table 3.0.</p> <table border="1" data-bbox="495 472 1274 1344"> <thead> <tr> <th colspan="2" data-bbox="495 472 1274 504"><i>Table 3.0: J1939 Compliance</i></th> </tr> <tr> <th data-bbox="495 504 722 556">OSI Network Model Layer</th> <th data-bbox="722 504 1274 556">J1939 Standard</th> </tr> </thead> <tbody> <tr> <td data-bbox="495 556 722 640">Physical</td> <td data-bbox="722 556 1274 640">J1939/11 – Physical Layer, 250K bit/s, Twisted Shielded Pair. J1939/15 - Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP).</td> </tr> <tr> <td data-bbox="495 640 722 787" rowspan="2">Data Link</td> <td data-bbox="722 640 1274 672">J1939/21 - April 2001 – Data Link Layer</td> </tr> <tr> <td data-bbox="722 672 1274 787">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 supports the transport protocols 60416 and 60160.</td> </tr> <tr> <td data-bbox="495 787 722 966" rowspan="2">Network Layer</td> <td data-bbox="722 787 1274 850">J1939/81 – May 2003 - Network Management J1939, Appendix B – Address and Identity Assignments</td> </tr> <tr> <td data-bbox="722 850 1274 966">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 data-bbox="495 966 722 1344" rowspan="3">Application Layer</td> <td data-bbox="722 966 1274 997">J1939/71 – November 2006 - Vehicle Application Layer</td> </tr> <tr> <td data-bbox="722 997 1274 1081">Refer to Table 1.0.</td> </tr> <tr> <td data-bbox="722 1081 1274 1344">J1939/73 – September 2006 - Application Layer – Diagnostics The TC4 can be configured to send "Active Diagnostic Trouble Code" DM1 messages (PGN 65226) for any 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>	<i>Table 3.0: J1939 Compliance</i>		OSI Network Model Layer	J1939 Standard	Physical	J1939/11 – Physical Layer, 250K bit/s, Twisted Shielded Pair. J1939/15 - Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP).	Data Link	J1939/21 - April 2001 – Data Link Layer	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 supports the transport protocols 60416 and 60160.	Network Layer	J1939/81 – May 2003 - Network Management J1939, Appendix B – Address and Identity Assignments	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).	Application Layer	J1939/71 – November 2006 - Vehicle Application Layer	Refer to Table 1.0.	J1939/73 – September 2006 - Application Layer – Diagnostics The TC4 can be configured to send "Active Diagnostic Trouble Code" DM1 messages (PGN 65226) for any 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).
<i>Table 3.0: J1939 Compliance</i>																	
OSI Network Model Layer	J1939 Standard																
Physical	J1939/11 – Physical Layer, 250K bit/s, Twisted Shielded Pair. J1939/15 - Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP).																
Data Link	J1939/21 - April 2001 – Data Link Layer																
	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 supports the transport protocols 60416 and 60160.																
Network Layer	J1939/81 – May 2003 - Network Management J1939, Appendix B – Address and Identity Assignments																
	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).																
Application Layer	J1939/71 – November 2006 - Vehicle Application Layer																
	Refer to Table 1.0.																
	J1939/73 – September 2006 - Application Layer – Diagnostics The TC4 can be configured to send "Active Diagnostic Trouble Code" DM1 messages (PGN 65226) for any 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).																
FMI	There are four FMIs associated with each thermocouple channel and include the following functions: High Temperature Shutdown; High Temperature Warning; Low Temperature Warning; and Thermocouple Open Circuit.																
Diagnostics	The controller stores diagnostic data in a non-volatile log. There are four diagnostic log entries associated with each input channel. Each entry is a record of the SPN, FMI and OC for any fault that has occurred. There are eight setpoints associated with if and how the ECU will send diagnostic messages for each channel. For more details refer to the user manual.																

Electrical Connections

Refer to Table 4.0.
 Deutsch DTM series 24 pin receptacle (DTM13-12PA-12PB-R008)
 Mating plugs kits are available on request and include Deutsch DTM06-12SA and DTM06-12SB with 2 wedgelocks (WM12S) and 24 contacts (0462-201-20141).
 20 AWG wire is recommended for use with contacts 0462-201-20141.

Use dielectric grease on the pins when installing the controller.

Key Arrangement B (black)

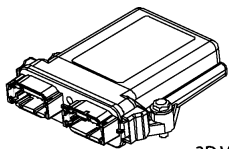


Key Arrangement A (grey)

FRONT VIEW 24 PIN RECEPTACLE

Packaging and Dimensions

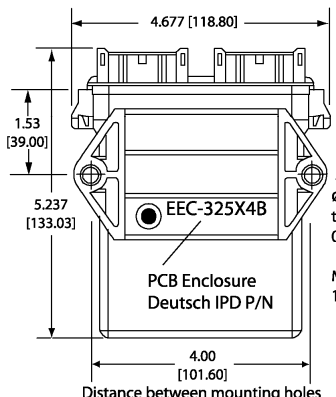
High Temperature Nylon housing, Deutsch IPD PCB Enclosure (EEC-325X4B)
 4.62 x 5.24 x 1.43 inches 117.42 x 133.09 x 36.36 mm (W x L x H excluding mating plug)



3D VIEW
 Housing with 24 Pin Receptacle

HOUSING DIMENSIONS

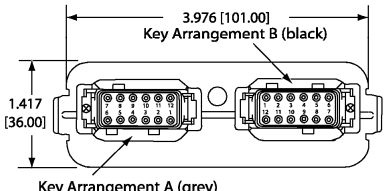
Housing Material: High Temperature Nylon (Black)



BOTTOM VIEW

Height 1.368 [34.75] with 24 pin receptacle
 Mounting Holes: \varnothing 0.29 [7.40] through 2 pl for 0.25 [6.00] fastener
 Mounting flange: 16 mm [0.63 in] thick

FRONT VIEW 24-PIN RECEPTACLE (NOT TO SCALE)



Mating Plug Assemblies for 24-pin receptacle:
 Deutsch IPD P/N: DTM06-12SA and DTM06-12SB with wedgelocks WM12S and contacts (Contact factory for contact specification.)

Dimensions: inches [mm] excluding mating plug(s)

Table 4.0 - Typical Connections, AXTC4

Grey Connector		Black Connector	
Pin #	Function	Pin #	Function
1	RS-232_GND	1	TC IN1+
2	RS-232_TXD	2	TC IN1-
3	RS-232_RXD	3	TC1_Shield
4	Not Used	4	TC IN2+
5	Frame GND	5	TC IN2-
6	Battery -	6	TC2_Shield
7	Battery +	7	TC3_Shield
8	Not Used	8	TC IN3-
9	Not Used	9	TC IN3+
10	CAN_L	10	TC4_Shield
11	CAN_H	11	TC IN4-
12	CAN_Shield	12	TC IN4+

Note: CANopen® is a registered community trade mark 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: TDAXTC4-07/22/09