

### 3 Encoder, 7 Signal Inputs CAN Controller

3 Encoder, 1 Universal Signal, 6 Digital/PWM/HZ Inputs  
CAN (SAE J1939) or CANopen  
with Electronic Assistant

P/N: AX030140

#### Features:

- 1 user selectable universal signal input:
  - 0-5 V
  - 0-10 V
  - 0-20 mA
  - 4-20 mA
  - PWM (low or high frequency)
  - Frequency/RPM
  - Counter
  - Digital
- 4 user selectable digital signal inputs:
  - PWM (low or high frequency)
  - Frequency/RPM
  - Digital
- 2 digital inputs
- 3 encoder inputs
- 3-way isolation between power, inputs and CAN
- 12V, 24V, 48 Vdc (nominal) power input
- 1 CAN port (SAE J1939) or CANopen
- Rugged packaging and connectors (TE Deutsch)
- Standard control logic
- CE mark (EMC Directive)
- Electronic Assistant for parameter configuration



**Description:** The 3 Encoder, 7 Signal Input Module accepts up to 3 encoders; 1 analog or digital type signal inputs (0-5V, 0-10V, 0-20 mA or 4-20 mA, Digital, PWM, Frequency/RPM or Counter); 4 digital type signal inputs (Digital, PWM, Frequency/RPM) and 2 Digital inputs. The modules can be connected to a variety of analog machine sensors or levers, PLC's, switches, PWM signals, etc. It interfaces with the machine's CAN network (SAE J1939). Standard embedded software is provided. Rugged IP67 rated packaging in addition to a wide-ranging power supply input section for 12V, 24V or 48Vdc power suits applications in the harsh environment of mobile equipment with on-board battery power. All setpoints are user configurable using the Electronic Assistant.

**Applications:** The controller is designed to meet the rugged demands of construction equipment, power generator sets, and industrial machine control applications.

#### Ordering Part Numbers:

Model P/N	Baud Rate
AX030140	SAE J1939, 250 kbps
AX030140-01	SAE J1939, 500 kbps
AX030140-02	SAE J1939, 1 Mbps
AX030141	CANopen

#### Accessories:

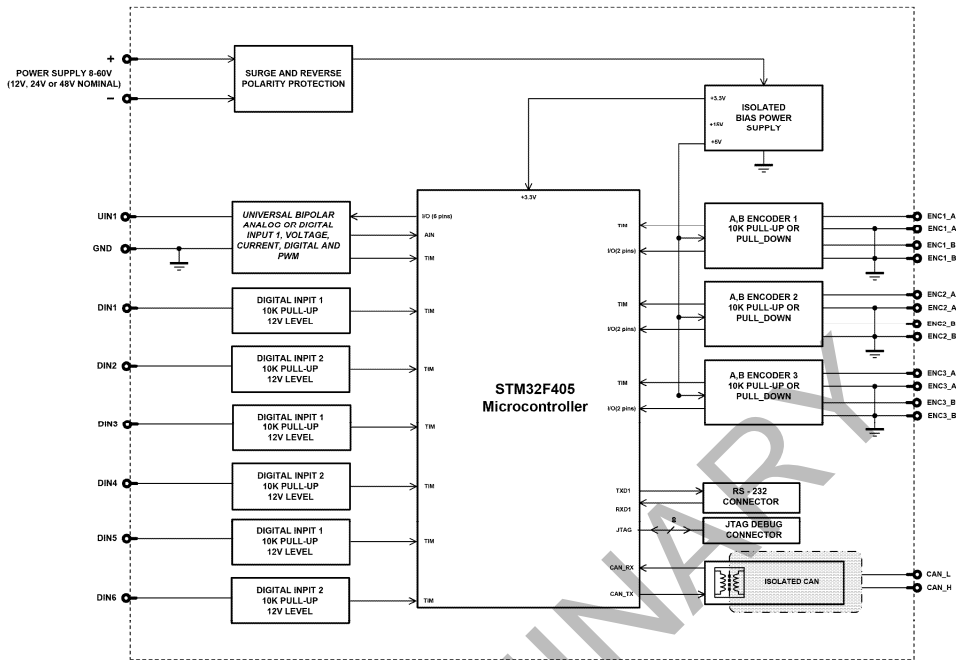
**PL-DTM06-12SA-12SB** Mating Plug Kit (1 DTM06-12S, DTM06-12SB, 2 WM12S, 24 contacts)

Electronic Assistant Configuration KIT: **AX070502**

In Europe:  
Axiomatic Technologies Oy  
Höytämöntie 6  
33880 LEMPÄÄLÄ - Finland  
Tel. +358 103 375 750  
Fax. +358 3 3595 660  
www.axiomatic.fi

In North America:  
Axiomatic Technologies Corporation  
5915 Wallace Street  
Mississauga, ON Canada L4Z 1Z8  
Tel. 1 905 602 9270  
Fax. 1 905 602 9279  
www.axiomatic.com

# 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 [www.axiomatic.com/service.html](http://www.axiomatic.com/service.html).

## Power Input Specifications

Power Supply Input - Nominal	12, 24 or 48Vdc nominal operating voltage 8...60 Vdc power supply range for voltage transients
Surge Protection	Provided
Reverse Polarity Protection	Provided
Quiescent Current	55 mA @ 12Vdc; 28 mA @ 24Vdc Typical

## Signal Input Specifications

Encoder Inputs	Three 2-phase, phase A and B incremental encoder inputs Range: 0.5 to 60 kHz Amplitude: up to +Vps 1 MOhm impedance or Active High with 10K Pullup or Active Low with 10K Pulldown resistor to GND
----------------	---

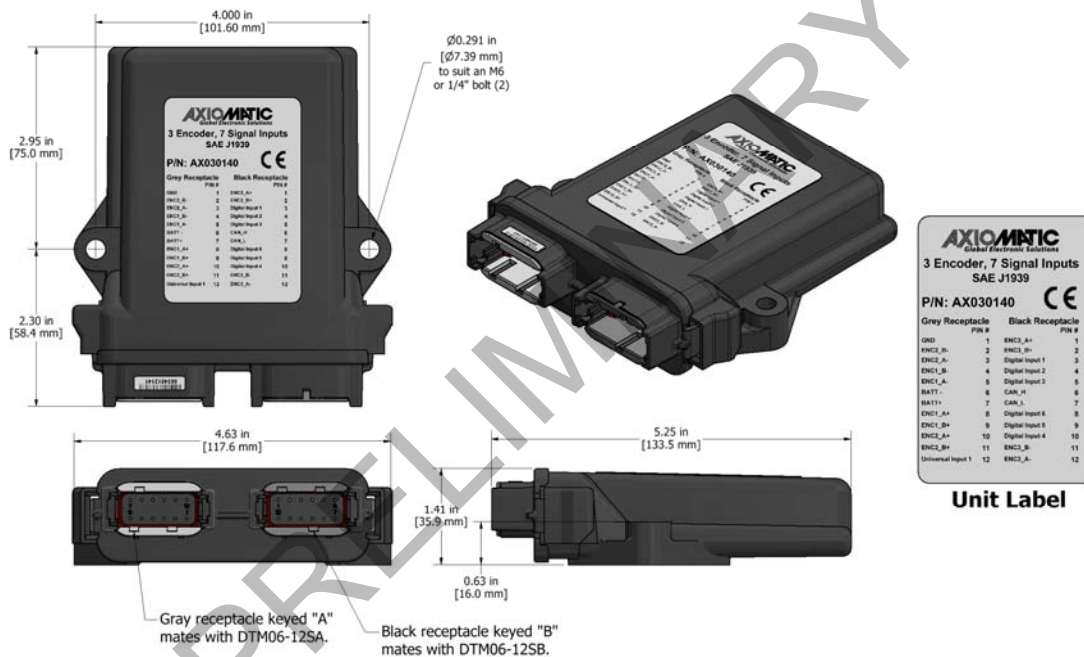
Universal Input	<p>1 user selectable input</p> <ul style="list-style-type: none"> <li>Analog 12-bit (0-5V, 0-10V, 0-20 mA, 4-20 mA)</li> <li>PWM 12-bit (low or high frequency) – auto detect 0.5 to 50 kHz, 0-100%</li> <li>Frequency/RPM – auto detect 0.5 to 50 kHz, 0-100%</li> <li>Counter input 16-bit</li> <li>Digital (active high/active low) [ON when input <math>\geq</math> 1.5V]</li> </ul> <p>The “<b>Input Sensor Type</b>” setpoint is used to configure input type. All inputs with the exception of 16-Bit Counter are sampled every 1ms. Analog Input types have a 12-bit resolution. With current inputs, short circuit protection is provided.</p>																																												
Digital Inputs 1-6	<p>4 user selectable inputs</p> <ul style="list-style-type: none"> <li>PWM 12-bit (low or high frequency)</li> <li>Frequency/RPM auto detect 0.5 to 50 kHz, 0-100%</li> <li>Digital (active high with 10K pullup) [ON when input <math>\geq</math> 1.5V]</li> </ul> <p>2 digital inputs (inputs 3 and 6)</p> <ul style="list-style-type: none"> <li>Digital (active high with 10K pullup) [ON when input <math>\geq</math> 1.5V]</li> </ul>																																												
Minimum and Maximum Ratings	<table border="1" data-bbox="613 680 1214 1031"> <thead> <tr> <th colspan="4">Table 1.0. Absolute Maximum and Minimum Ratings</th> </tr> <tr> <th>Characteristic</th> <th>Min</th> <th>Max</th> <th>Units</th> </tr> </thead> <tbody> <tr> <td>Power Supply</td> <td>8</td> <td>60</td> <td>V dc</td> </tr> <tr> <td>Voltage Input</td> <td>0</td> <td>43</td> <td>V dc</td> </tr> <tr> <td>Current Input</td> <td>0</td> <td>21</td> <td>mA</td> </tr> <tr> <td>Current Input – Voltage Level</td> <td>0</td> <td>12</td> <td>Vdc</td> </tr> <tr> <td>Digital Type Input – Voltage Level</td> <td>0</td> <td>43</td> <td>Vdc</td> </tr> <tr> <td>PWM Duty Cycle</td> <td>0</td> <td>100</td> <td>%</td> </tr> <tr> <td>PWM Frequency</td> <td>50</td> <td>20 000</td> <td>Hz</td> </tr> <tr> <td>PWM Voltage pk - pk</td> <td>0</td> <td>43</td> <td>V dc</td> </tr> <tr> <td>RPM Frequency</td> <td>50</td> <td>20 000</td> <td>Hz</td> </tr> </tbody> </table>	Table 1.0. Absolute Maximum and Minimum Ratings				Characteristic	Min	Max	Units	Power Supply	8	60	V dc	Voltage Input	0	43	V dc	Current Input	0	21	mA	Current Input – Voltage Level	0	12	Vdc	Digital Type Input – Voltage Level	0	43	Vdc	PWM Duty Cycle	0	100	%	PWM Frequency	50	20 000	Hz	PWM Voltage pk - pk	0	43	V dc	RPM Frequency	50	20 000	Hz
Table 1.0. Absolute Maximum and Minimum Ratings																																													
Characteristic	Min	Max	Units																																										
Power Supply	8	60	V dc																																										
Voltage Input	0	43	V dc																																										
Current Input	0	21	mA																																										
Current Input – Voltage Level	0	12	Vdc																																										
Digital Type Input – Voltage Level	0	43	Vdc																																										
PWM Duty Cycle	0	100	%																																										
PWM Frequency	50	20 000	Hz																																										
PWM Voltage pk - pk	0	43	V dc																																										
RPM Frequency	50	20 000	Hz																																										
Input Accuracy	<table border="1" data-bbox="613 1043 1295 1297"> <thead> <tr> <th colspan="3">Table 2.0. Input Accuracy</th> </tr> <tr> <th>Input Type</th> <th>Accuracy</th> <th>Resolution</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>+/- 1%</td> <td>1 [mV]</td> </tr> <tr> <td>Current</td> <td>+/- 1%</td> <td>1 [uA]</td> </tr> <tr> <td>PWM</td> <td>+/- 1% (&lt;5kHz) +/- 2% (&gt;5kHz)</td> <td>0.1 [%]</td> </tr> <tr> <td>Frequency/RPM</td> <td>+/- 1%</td> <td>0.01 [Hz]</td> </tr> </tbody> </table>	Table 2.0. Input Accuracy			Input Type	Accuracy	Resolution	Voltage	+/- 1%	1 [mV]	Current	+/- 1%	1 [uA]	PWM	+/- 1% (<5kHz) +/- 2% (>5kHz)	0.1 [%]	Frequency/RPM	+/- 1%	0.01 [Hz]																										
Table 2.0. Input Accuracy																																													
Input Type	Accuracy	Resolution																																											
Voltage	+/- 1%	1 [mV]																																											
Current	+/- 1%	1 [uA]																																											
PWM	+/- 1% (<5kHz) +/- 2% (>5kHz)	0.1 [%]																																											
Frequency/RPM	+/- 1%	0.01 [Hz]																																											
Input Impedance	<p>0-5V: 1 MOhm 0-10V: 170 kOhm 0(4)-20mA: 249 Ohm Frequency/Digital Input: Pull Up/Pull Down 1 MOhm</p>																																												
Scan Rate	<p>Each input is scanned in 100uS. A complete scan of 10 inputs occurs with new measured values every 1mS.</p>																																												
Analog GND	<p>1 Analog GND connections is provided.</p>																																												

## General Specifications

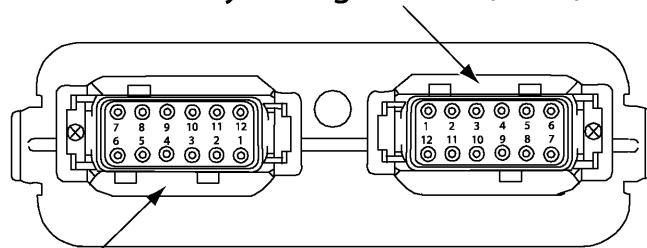
Microprocessor	STM32F405RG
Isolation	3-way isolation between power, inputs and CAN 400 Vrms
Communications	1 CAN port (2.0B, SAE J1939) Model AX030140 – 250 kbps baud rate Model AX030140-01 – 500 kbps baud rate Model AX030140-02 – 1 Mbps baud rate A CANopen® model is available, ordering part number AX030141.
EMC Compliance	CE marking
Vibration	MIL-STD-202G, Method 204D, test condition A – 10 g peak (Sine) MIL-STD-202G, Method 214A, test condition B – 7.68 Grms (Random)
Shock	MIL-STD-202G, Method 213B, test condition A 50 g half sine pulse, 6 ms, 6 pulses per axis
User Interface	User configuration and diagnostics are provided with the Axiomatic Electronic Assistant.
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.
Control Logic	<p>Configurable properties of the controller are divided into function blocks, namely input function block, diagnostic function block; lookup table function block, programmable logic function block, math function block, constant data block and conditional block, CAN receive message function block and CAN transmit message function block. Input function block includes properties used to select input sensor functionality. Diagnostic function block properties are used to configure fault detection and reaction functionalities. The Math function block gives user an opportunity to process inputs with basic mathematical or logical functions. The CAN transmit message function block configures properties of the messages sent to the CAN bus.</p> <p>The software was designed to provide flexibility to the user with respect to messages sent from the module (ECU) over the CAN bus, by providing:</p> <ul style="list-style-type: none"> <li>• Configurable ECU Instance in the NAME (to allow multiple ECU's on the same network)</li> <li>• Configurable Input Parameters</li> <li>• Configurable PGN and Data Parameters</li> <li>• Configurable Diagnostic Messaging Parameters, as required</li> <li>• Diagnostic Log, maintained in non-volatile memory</li> </ul> <p>The CAN Transmit function block is used to send any output from another function block (i.e. input, math) to the J1939 network. The ECU has ten CAN Transmit Messages and each message has 5 signals.</p> <p>The “<b>Transmit PGN</b>” setpoint sets PGN used with the message. The user should be familiar with the SAE J1939 standard and select values for PGN/SPN combinations as appropriate from section J1939/71. By default, all messages are sent on Proprietary B PGNs as broadcast messages.</p> <p>None of the application layer PGNs are supported as part of the default configurations, but they can be selected as desired for transmit function blocks.</p> <p>Setpoints are accessed using standard Memory Access Protocol (MAP) with proprietary addresses. The Electronic Assistant (EA) allows for quick and easy configuration of the unit over CAN network.</p> <p>Refer to the User Manual UMAX030140 for details. The AX030140 can be upgraded with new application firmware over the CAN bus using the Electronic Assistant. <i>For application-specific control logic, contact Axiomatic.</i></p>
Electrical Connections	TE Deutsch DTM series 24 pin receptacle (DTM13-12PA-12PB-R008) Mating plug: TE 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. Refer to Table 3.0 for pinout.
Enclosure and Dimensions	High Temperature Nylon housing – TE Deutsch PCB Enclosure (EEC-325X4B) 4.63 x 5.25 x 1.41 inches 117.60 x 133.50 x 35.90 mm

	(W x L x H excluding mating plugs)
Operating Conditions	-40 to 85°C (-40 to 185°F)
Weight	0.55 lb. (0.25 kg)
Protection	IP67, Unit is conformal coated in the housing.
Mounting	<p>Mounting holes sized for ¼ inch or M6 bolts. The bolt length will be determined by the end-user's mounting plate thickness. The mounting flange of the controller is 0.63 inches (16 mm) thick. 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.</p> <p>All field wiring should be suitable for the operating temperature range.</p> <p>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).</p>

### Dimensions and Typical Connections:



### Key Arrangement B (black)



### Key Arrangement A (grey)

### FRONT VIEW 24 PIN RECEPTACLE

<b>Table 3.0. Electrical Pin Out</b>			
<b>Grey Connector</b>		<b>Black Connector</b>	
<b>Pin #</b>	<b>Function</b>	<b>Pin #</b>	<b>Function</b>
1	Analog GND	1	ENC3_A+
2	ENC2_B-	2	ENC3_B+
3	ENC2_A-	3	Digital Input 1
4	ENC1_B-	4	Digital Input 2
5	ENC1_A-	5	Digital Input 3 (Digital only)
6	Batt -	6	CAN_H
7	Batt +	7	CAN_L
8	ENC1_A+	8	Digital Input 6 (Digital only)
9	ENC1_B+	9	Digital Input 5
10	ENC2_A+	10	Digital Input 4
11	ENC2_B+	11	ENC3_B-
12	Universal Input	12	ENC3_A-

Notes:

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

Form: TDAX030140-05/01/20

PRELIMINARY