

CAN to Bluetooth BRIDGE AND DATALOGGER WITH CAN

USER MANUAL

P/N: AX141100

VERSION HISTORY

Version	Date	Author	Modification
1.0.0	Nov 18, 2016	Antti Keränen	Initial Version
--	Nov. 18, 2016	Amanda Wilkins	Marketing Review
1.0.1	Mar. 5, 2017	Antti Keränen	CAN Rx filtering description updated, CAN Scope function and BT MAP Tool description added.
1.0.2	Mar. 20, 2017	Antti Keränen	New functionality added (firmware v1.01). SPP command reference updated.
--	March 20, 2017	Amanda Wilkins	Updated connection and operating range in Technical Spec.
1.0.3	June 12, 2017	Antti Keränen	Bluetooth node ID configuration added. BT module communication failure detection added (in section 1).
1.0.4	June 15, 2017	Antti Keränen	CAN RX Filtering description enhanced.
1.0.5	February 16, 2018	Antti Keränen	Android apps' links updated.
1.0.6	February 26, 2018	Antti Keränen	Default PIN codes note added.
1.0.7	June 28, 2023	M Ejaz	Fixed legacy issues Added FCC, IC, and BT SIG compliance
1.0.8	September 13, 2023	Kiril Mojsov	Fixed Further Legacy Issues
1.0.9	July 25, 2024	M Ejaz	Added Android and iOS app links



DEFAULT PIN CODES

Pairing: 000000

Configuration mode: 000000

ACRONYMS

ACK	Positive Acknowledgement (from SAE J1939 standard)
BATT +/-	Battery positive (a.k.a. Vps) or Battery Negative (a.k.a. GND)
BD ADDR	Bluetooth Device Address
BLE	Bluetooth Low Energy
BT	Bluetooth
EA	Axiomatic Electronic Assistant (A Service Tool for Axiomatic ECUs)
ECU	Electronic Control Unit (from SAE J1939 standard)
GND	Ground reference (a.k.a. BATT-)
MAP	Memory Access Protocol
PGN	Parameter Group Number (from SAE J1939 standard)
SPN	Suspect Parameter Number (from SAE J1939 standard)
TP	Transport Protocol

LIST OF CONTENTS

1. OVERVIEW OF THE CONTROLLER	8
2. CAN TO BLUETOOTH FUNCTION BLOCKS.....	10
2.1. PIN codes	10
2.2. CAN Bus Configuration	11
2.3. Connection Options	12
2.4. CAN Receive Filtering	13
2.5. CAN Data Logging.....	14
2.6. Flash Memory Operations	15
2.7. Real Time Clock Settings	16
2.8. Miscellaneous Settings.....	17
2.9. CAN Scope	18
2.10. LED Configuration	19
3. INSTALLATION INSTRUCTIONS	20
3.1. Dimensions and Pinout.....	20
4. OVERVIEW OF J1939 FEATURES.....	21
4.1. Introduction to Supported Messages.....	21
4.2. NAME, Address and Software ID	21
5. SPP COMMUNICATIONS.....	23
5.1. Overall message format	23
5.2. Message types.....	23
5.2.1. CAN messages.....	24
5.2.2. MAP access.....	24
5.2.3. Configuration messages.....	24
5.2.4. Download flash contents.....	26
5.2.5. LED commands	26
6. ECU SETPOINTS ACCESSED WITH THE AXIOMATIC ELECTRONIC ASSISTANT.....	27
7. ACCESSING REMOTE AXIOMATIC ECUS WITH BT MAP TOOL	28
8. REFLASHING OVER CAN WITH THE AXIOMATIC EA BOOTLOADER.....	29

LIST OF TABLES

Table 1 – CAN Rx filter definition 13

Table 2 – Flash chip details..... 15

Table 3 – AX141100 Connector Pinout..... 20

Table 4 – Overall message format 23

Table 5 – Proprietary SPP message types 23

LIST OF FIGURES

Figure 1 – AX141100 Block Diagram	8
Figure 2 – PIN Code settings	10
Figure 3 – CAN bus configuration	11
Figure 4 – Connection options.....	12
Figure 5 – CAN Receive Filtering	13
Figure 6 – CAN Logging Configuration	14
Figure 7 – Flash memory operations.....	15
Figure 8 – Real Time Clock	16
Figure 9 – Miscellaneous settings	17
Figure 10 – CAN Scope.....	18
Figure 11 – LED Configuration	19
Figure 12 – AX141100 Dimensional Drawing	20
Figure 13 – BT MAP Tool	28

REFERENCES

J1939	Recommended Practice for a Serial Control and Communications Vehicle Network, SAE, April 2011
J1939/21	Data Link Layer, SAE, December 2010
J1939/71	Vehicle Application Layer, SAE, March 2011
J1939/73	Application Layer-Diagnostics, SAE, February 2010
J1939/81	Network Management, SAE, May 2003
TDAX141100	Technical Datasheet, CAN to Bluetooth bridge and datalogger with CAN, Axiomatic Technologies
UMAX07050x	User Manual, Axiomatic Electronic Assistant and USB-CAN, Axiomatic Technologies

This document assumes the reader is familiar with the SAE J1939 standard. Terminology from the standard is used, but not described in this document.



NOTE: This product is supported by Axiomatic Electronic Assistant V5.13.84.0 and higher.

1. Overview of The Controller

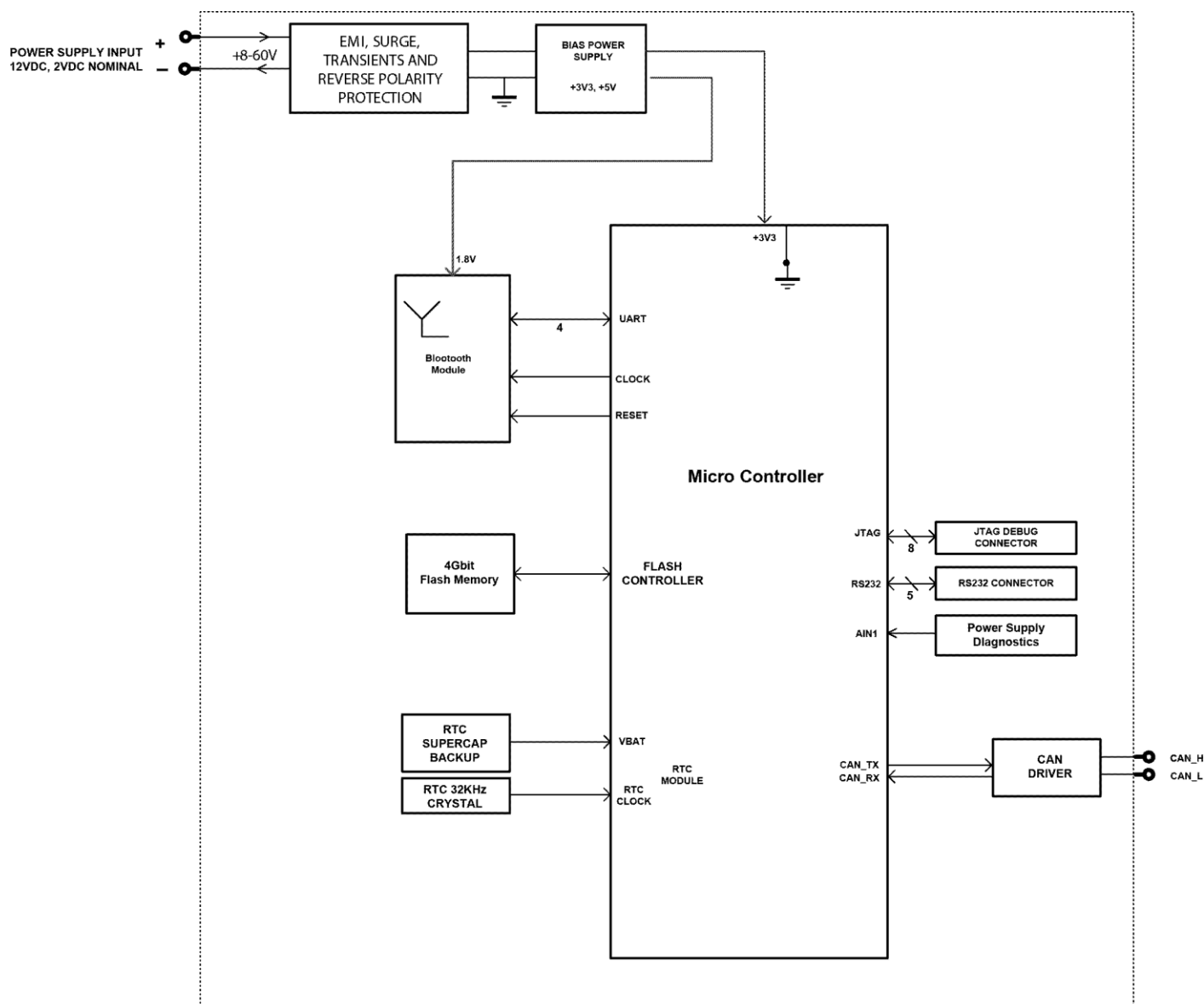


Figure 1 – AX141100 Block Diagram

The CAN to Bluetooth device (later CAN2BT) can be used for accessing the CAN bus and the other CAN nodes connected to it using Bluetooth communications and a smart device, such as a phone or a tablet.

The CAN2BT device provides also data logging capabilities. It has 4GBits of internal Flash storage for storing the selected CAN messages with time stamp information.

The CAN2BT device can be configured using an Android and iOS application called *CAN2BLE Configuration*. With this tool, all the functionality of the CAN2BT device can be configured, such as setting PIN codes, connection options, CAN receive filtering and CAN data logging rules. Also RTC time setting and different Flash memory operations such as download data and data erase are supported.

The CAN2BT device can be operated in two main operation modes, namely the Interface Mode and the Bridge Mode. The Interface Mode is targeted for data logging operation and in this mode the CAN2BT device can be accessed using the Axiomatic Electronic Assistant.

When in Bridge Mode, the CAN receive filtering is disabled and the device accepts all incoming CAN frames. The main purpose of the Bridge Mode is to use two CAN2BT devices as a wireless CAN data bridge between two different CAN networks. When in Bridge Mode, the CAN2BT device is transparent to the CAN bus and cannot be seen in the Axiomatic Electronic Assistant's list of J1939 nodes. The device can still be accessed using the *CAN2BLE Configuration* tool.

In case the module startup fails (a communication error between the CPU and the Bluetooth module is detected), the CAN2BT device will indicate the failure by sending the following DM1 (PGN 0xFECA / 65226) to CAN bus on 1s intervals. In addition to the DM1, the two built-in LEDs are blinking and not responding to user configuration nor control messages. In failure mode, the unit will be accessible only via the CAN bus.

Condition	Lamp	SPN	FMI	OC	Src.Address
BT module failure	MALFUNCTION	3368 (WCM1)	31	1	0xFB (251)

2. CAN to Bluetooth Function Blocks

This section explains the different functions and configuration available on the CAN2BT. The *CAN2BLE Configuration* Android application is used as a reference. The application is available from Google Play.

2.1. PIN codes

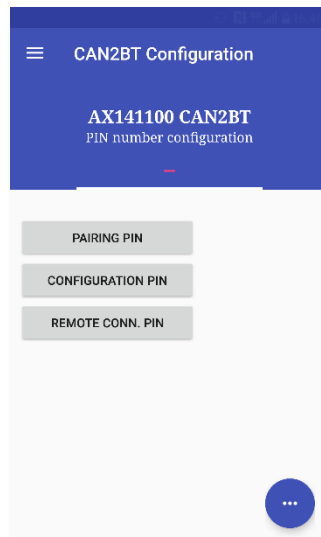


Figure 2 – PIN Code settings

The PIN Code settings allow the user to define PIN codes that are used when accessing the device. **Pairing PIN** is the PIN code that will be used when pairing the CAN2BT device with a new smart device. **Configuration PIN** code is required when configuration is accessed (most configuration options require that the CAN2BT device is put to configuration mode. Entering the configuration mode requires the user to enter the configuration PIN). **Remote Connection PIN** is the code that is used when the CAN2BT makes a connection with another CAN2BT device (when forming a data bridge for wireless CAN communications).



DEFAULT PIN CODES

Pairing: 000000

Configuration mode: 000000

2.2. CAN Bus Configuration



Figure 3 – CAN bus configuration

CAN bus configuration allows changing the CAN interface baudrate. The list of available baudrate options include 50k, 100k, 125k, 250k (default), 500k and 1M. When changing the baudrate, the CAN2BT device needs to be restarted (power cycled) to apply the new baudrate to the CAN interface.

The **Echo TX CAN Frames** makes the CAN2BT device to send back all CAN messages that are sent to its Bluetooth interface using commands 0x12 and 0x13. Please see section 5.2 for more info about CAN message sending.

2.3. Connection Options

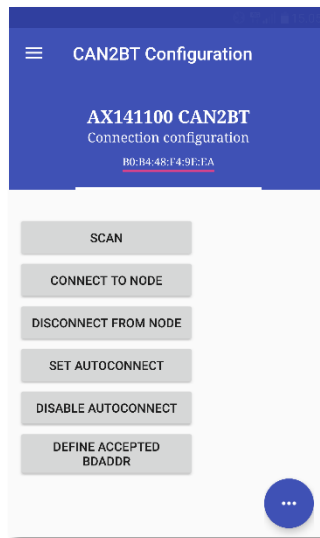


Figure 4 – Connection options

Connection options menu list the functions available for connecting the CAN2BT device to other CAN2BT node. **Scan** starts a scan for other Bluetooth nodes (CAN2BT works as a master). **Connect to node makes** a connection to one of the nodes returned in the Scan results. **Disconnect from node** disconnects the currently active connection. **Set autoconnect** can be used for setting a BD ADDRESS of a remote node with which the CAN2BT device will attempt to connect automatically at power on (targeted for data bridge operations). **Disable autoconnect** will reset the BD ADDRESS set using command **Set autoconnect**.

Define accepted BD ADDR lets the user to configure a Bluetooth address that will be the only address from which connections are allowed. All other nodes trying to connect to the CAN2BT device will be ignored.

All functions that are used for defining BD ADDRESSES expect to receive an index number that matches to the BD ADDR list returned upon successful device scan (using the **Scan** command). The list of valid numbers is from 1 to number of Bluetooth nodes found. Index 0 is also accepted, it is interpreted as the BD ADDR of the device that is currently used for configuring the device. This is useful in cases where the accepted BD ADDR needs to be set.

2.4. CAN Receive Filtering

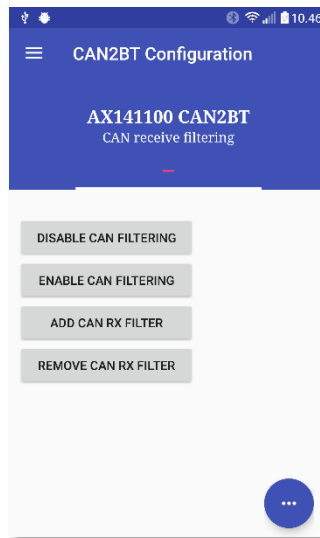


Figure 5 – CAN Receive Filtering

By default the device won't read in all received CAN messages. With the CAN receive filtering functions, the user can change this behaviour. **Disable CAN filtering** removes all CAN receive filtering and makes the CAN2BT device capable of receiving all CAN frames on the bus. With CAN filtering disabled, the CAN2BT device is invisible to the CAN bus. This is the mode that is preferred for using the device as a bridge between two CAN buses.

Enable CAN filtering restores the default CAN receive filtering and makes the CAN2BT device visible to the CAN bus (it will respond to Address Claim messages).

Add CAN RX filter lets the user to define a single CAN filter and optional mask that are added to the low level (HW) CAN receive filter registers. Please note, that if the mask is not specified, the firmware uses a default mask of 29 (or 11) bits wide that will compare all bits in the received CAN frame against the specified filter.

Up to 28 filter definitions will be accepted. The **Remove CAN RX filter** will remove the specified filter (the removal is done by comparing the IDs of the configured filters and the ID specified to be removed).

The CAN filter definition for adding and removing filters is as follows:

bit 31	bit 30	bits 29-0
Use ExtID	Use RTR	Filter ID

Table 1 – CAN Rx filter definition

Example 29bit ID filter & mask for receiving all (J1939) frames with Source Address 0xF9

Filter: **800000F9**, Mask: **FF**

Example 11bit ID filter & mask for receiving ID 0x701 (CANopen® master HB)

Filter: **701**, Mask: **7FF**

2.5. CAN Data Logging

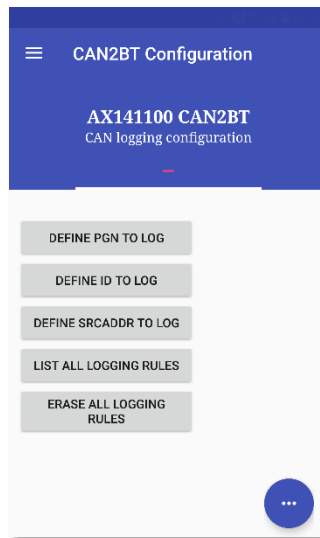


Figure 6 – CAN Logging Configuration

The Datalogging configuration includes defining different PGNs or Source Addresses to log. These two functions assume PGNs and Source Addresses as defined in the J1939 specification. The **Define ID to log** allows the user to freely define a CAN frame ID that will be logged.

Please note, that the CAN Logging configuration does not change the CAN receive filtering. In most cases (unless the device has CAN receive filtering disabled), the user has to define proper CAN receive filters in order the CAN2BT to be able to receive all CAN frames that need to be logged.

The current data logging rules can be read using the **List all logging rules** function. The **Erase all logging rules** will erase all rules.

2.6. Flash Memory Operations

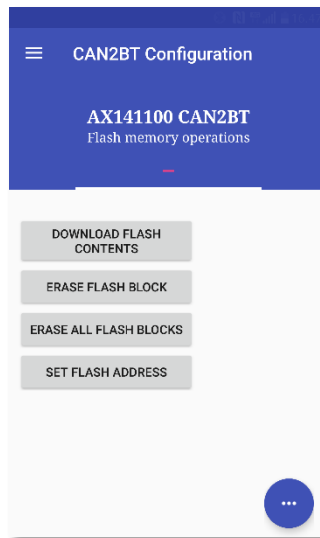


Figure 7 – Flash memory operations

Contents of the Flash memory can be downloaded to an Android smart device using the Download flash contents. This function will transfer 96 bytes of the Flash contents at a time, please refer to section 5 for details.

The Flash can be erased few blocks at a time or then a full erase can be done using Erase all flash blocks. The Flash erase functions will require that the device is in configuration mode, so the Flash contents are protected with the Configuration PIN.

The current flash address (block and page) can be set using the Flash address function. All the following Flash writes will use this setting.

Erasing a single block can be done by setting the erase start block and end block to a same value (please note that the flash erase is flash block specific). To download a single flash page, the start address (block & page) and end address (block & page) need to be set to a same value.

Flash type	Micron MT29F4G08ABADA (4GBits)
Bytes per page	2112
Pages per block	64
Blocks in total	4096

Table 2 – Flash chip details

2.7. Real Time Clock Settings

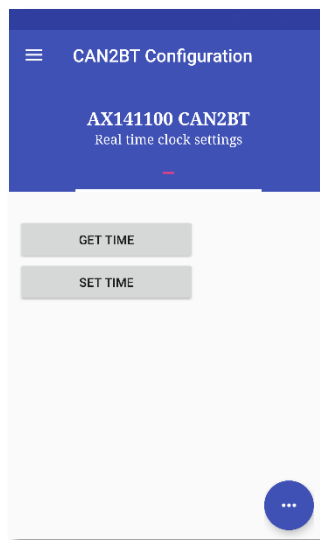


Figure 8 – Real Time Clock

There is an RTC on the CAN2BT device. The RTC is powered from a supercap, capable of keeping the time and data information for 96 hours of stand-by if fully charged before the stand-by period. The fully charging means that the CAN2BT device is being powered at least 8 hours continuously.

The time can be set using the **Set time** and read using the **Get time** function. Setting the time requires that the CAN2BT device is in configuration mode.

2.8. Miscellaneous Settings

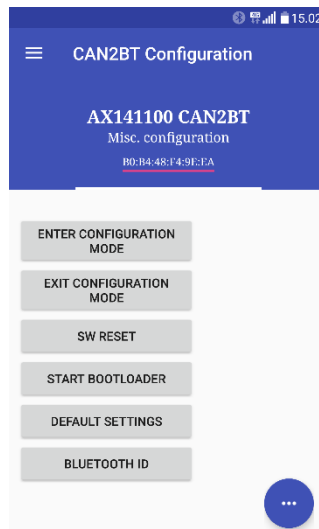


Figure 9 – Miscellaneous settings

The miscellaneous settings consist of setting the CAN2BT device to the configuration mode, and exiting the configuration mode. The CAN2BT device can be also SW reset and the CAN bootloader can be started for firmware updates (please also see section 8).

The **Enter Configuration** mode requires the user to enter the current Configuration PIN number. In case the smart device is disconnected from the CAN2BT device during configuration, the CAN2BT device automatically exits the configuration mode.

SW Reset will reset the CPU of the CAN2BT device. **Start bootloader** will set the start bootloader flag and then reset the CPU. This makes the CAN2BT device enter the firmware reflash mode, and it will be visible on the CAN bus and accessible from the Axiomatic EA as Bootloader #1 (please see section 8 for more detailed description of firmware reflashing). **Default settings** will restore factory default settings and then reset the CPU.

Bluetooth ID allows the user to configure the name that device will advertise. The default is "CAN2BT". In case there are multiple CAN2BT devices in range, it might be advantageous to configure unique names to different controllers. The Bluetooth ID accepts characters in range 0x20 ('space') to 0x7E ('~') and can hold up to 248 characters.

The configured Bluetooth ID is also available in the J1939 Software ID (SPN 234).

In case the CAN2BT device is not in configuration mode and the user tries to configure it, the configuration commands return non-zero values.

2.9. CAN Scope

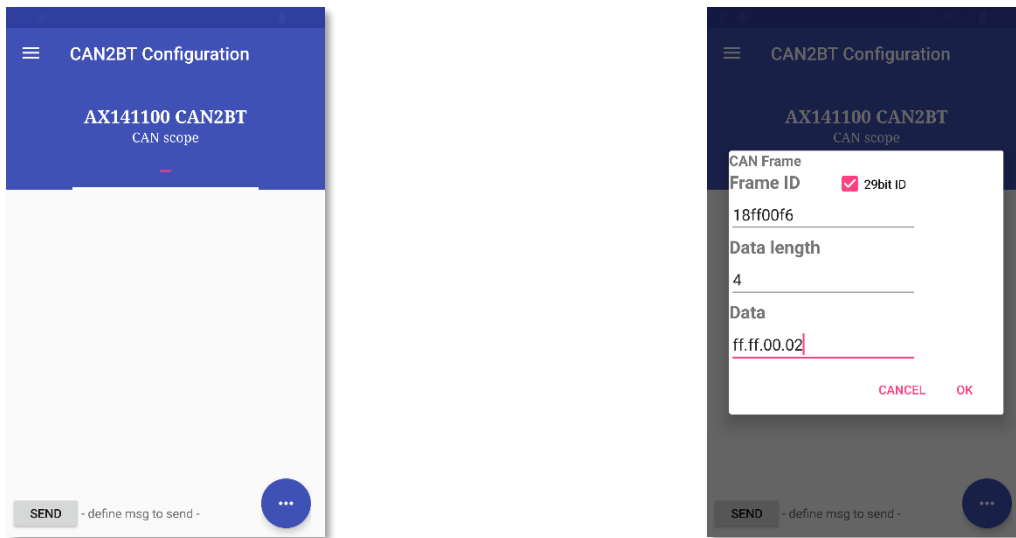


Figure 10 – CAN Scope

The CAN Scope function shows the frames on the CAN bus. Only the frames that pass the receive filters (please see section 2.4) are shown. The CAN Scope function can be also used for manually sending CAN frames to the bus.

The data for the frame to be sent is given in hexadecimal format. The data bytes for the CAN frame need to be given in sequence of bytes. The separator between the bytes can be one of the following characters:

: ; - , .

2.10. LED Configuration

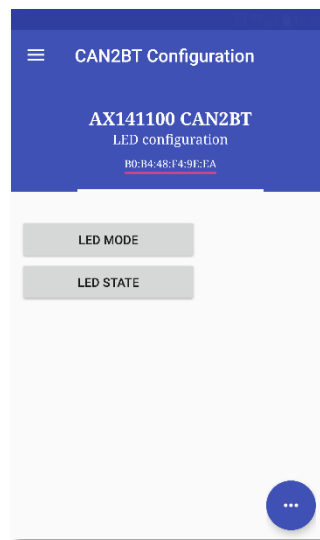


Figure 11 – LED Configuration

The build in LEDs of the CAN2BT device can be also manually controlled. The LED Mode function allows the user to set the LED function, default – LED activity based on BT RX and TX and manual – LED states as commanded using the LED commands. Please see section 5.2 for more detailed info about the available LED commands.

3. Installation Instructions

3.1. Dimensions and Pinout

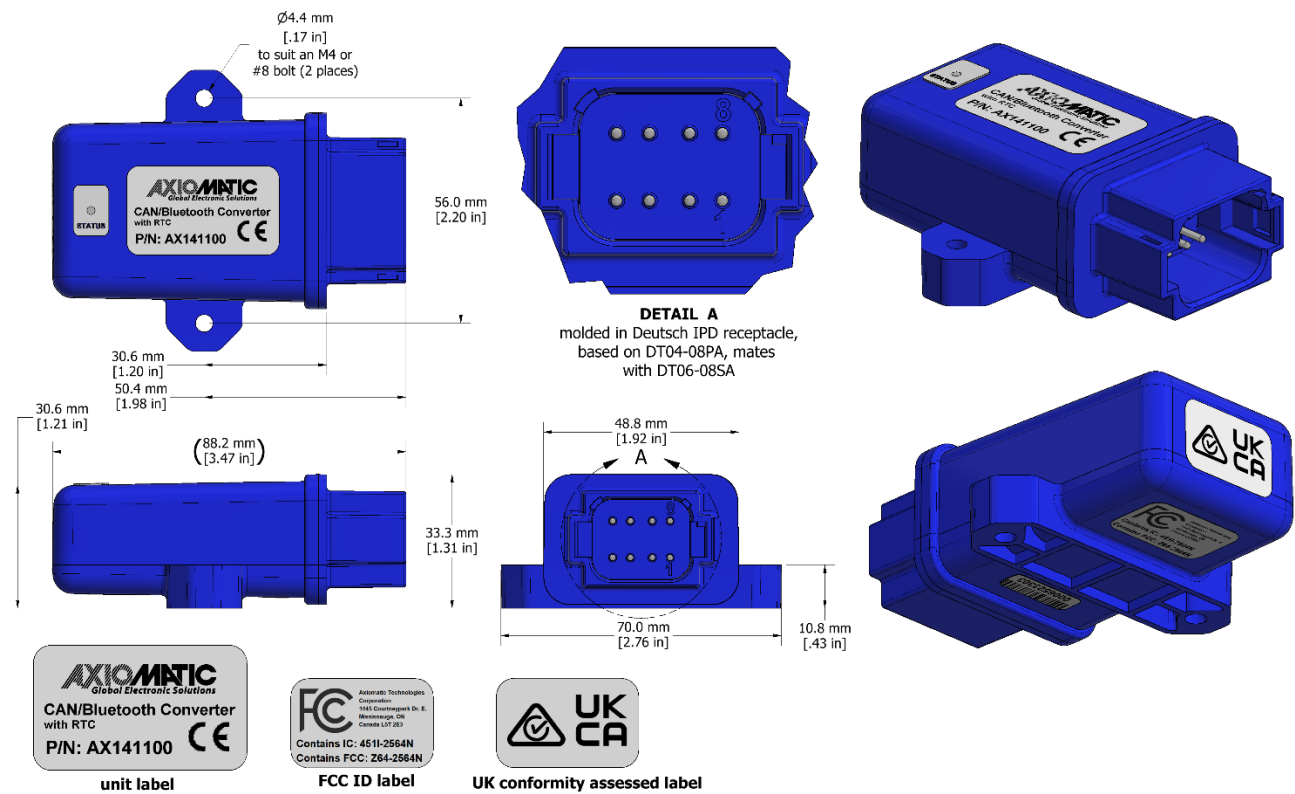


Figure 12 – AX141100 Dimensional Drawing

PIN #	FUNCTION
1	CAN_L
2	CAN_H
3	CAN_SHIELD
4	NOT USED
5	NOT USED
6	NOT USED
7	BATT +
8	BATT -

Table 3 – AX141100 Connector Pinout

4. Overview of J1939 Features

The software was designed to provide flexibility to the user with respect to messages sent from the ECU by providing:

- Configurable ECU Instance in the NAME (to allow multiple ECUs on the same network)

4.1. Introduction to Supported Messages

The ECU is compliant with the standard SAE J1939, and supports following PGNs from the standard.

From J1939-81 – Network Management

- Address Claimed/Cannot Claim 60928 0x00EE00
- Commanded Address 65240 0x00FED8

From J1939-71 – Vehicle Application Layer

- Software Identification 65242 0x00FEDA

Setpoints are accessed using standard Memory Access Protocol (MAP) with proprietary addresses. The AXIOMATIC Electronic Assistant (EA) allows for quick and easy configuration of the unit over CAN network.

4.2. NAME, Address and Software ID

The CAN to Bluetooth ECU has the following default for the J1939 NAME. The user should refer to the SAE J1939/81 standard for more information on these parameters and their ranges.

Arbitrary Address Capable	Yes
Industry Group	0, Global
Vehicle System Instance	0
Vehicle System	0, Non-specific system
Function	130, On-board data logger
Function Instance	1, Axiomatic AX141100
ECU Instance	0, First Instance
Manufacture Code	162, Axiomatic Technologies
Identity Number	Variable, uniquely assigned during factory programming for each ECU

The ECU Instance is a configurable setpoint associated with the NAME. Changing this value will allow multiple ECUs of this type to be distinguishable from one another when they are connected on the same network.

The default value of the “ECU Address” setpoint is 251 (0xFB), which is the default for an on board data logger device. The Axiomatic EA supports the selection of any address between 0 and 253. ***It is the user's responsibility to select an address that complies with the standard.*** The user must also be aware that since the unit is arbitrary address capable, if another ECU with a higher priority NAME contends for the selected address, the CAN to Bluetooth device will continue select the next highest address until it finds one that it can claim. See J1939/81 for more details about address claiming.

Software Identifier

PGN 65242		Software Identification		- SOFT
Transmission Repetition Rate:		On request		
Data Length:		Variable		
Extended Data Page:		0		
Data Page:		0		
PDU Format:		254		
PDU Specific:		218 PGN Supporting Information:		
Default Priority:		6		
Parameter Group Number:		65242 (0xFEDA)		
Start Position	Length	Parameter Name	SPN	
1	1 Byte	Number of software identification fields	965	
2-n	Variable	Software identification(s), Delimiter (ASCII “*”)	234	

Byte 1 is set to 5, and the identification fields are as follows.

(Part Number)*(Version)*(Date)*(Owner)*(Description)	
--	--

The Axiomatic EA shows all this information in “General ECU Information”, as shown below.

Note: The information provided in the Software ID is available for any J1939 service tool which supports the PGN -SOFT.

5. SPP Communications

The communications between a smart device such as a phone or a tablet and the CAN2BT device is based on Bluetooth Serial Port Profile (SPP). By default, the CAN2BT firmware declares itself as a SPP device (UUID: 00001101-0000-1000-8000-00805F9B34FB)

The messages are transferred in binary format, least significant byte first. The list of supported proprietary messages is shown below.

5.1. Overall message format

There is an ack response sent by the CAN2BT device after receiving the configuration messages.

The overall message format:

Byte 0	Byte 1	Byte 2	Byte 3	...	Byte n+2	Byte n+3	Byte n+4	Byte n+5	Byte n+6
<msg type>	<length>	<payload 0>	<payload 1>	...	<payload length-1>	<crc32>	<crc32>	<crc32>	<crc32>

Table 4 – Overall message format

in which the *<msg type>* is as listed in below. *<length>* is full message length without the four CRC32 bytes. CRC32 is selected because the support for it is readily available in Android.

All data that is expressed as Byte 0, Byte 1, ... in the message descriptions below, is expected to be either 16 bits or 32 bits wide data, broken down to bytes (8 bits) least significant byte first. The only exception is the PIN code data, that is expected to be formatted one digit per byte. The PIN codes are hard formatted to have 6 digits.

Available CAN baudrate options include: 0 – 50k, 1 – 100k, 2 – 125k, 3 – 250k, 4 – 500k, 5 – 1M

5.2. Message types

Message type	Direction	<msg type> byte
CAN data with StdID	SD* -> CAN2BT	0x12
CAN data with ExtID	SD* -> CAN2BT	0x13
CAN data with StdID	CAN2BT -> SD*	0x21
CAN data with ExtID	CAN2BT -> SD*	0x31
MAP write	SD* -> CAN2BT	0x34
MAP write response	CAN2BT -> SD*	0x43
MAP read	SD* -> CAN2BT	0x45
MAP read response	CAN2BT -> SD*	0x54
Download Flash contents	SD* -> CAN2BT	0x56
Download Flash contents response	CAN2BT -> SD*	0x65
Download Flash contents ACK	SD* -> CAN2BT	0x57
Download Flash contents ACK response	CAN2BT -> SD*	0x75
Change configuration	SD* -> CAN2BT	0x67
Change configuration response	CAN2BT -> SD*	0x76
LED state	SD* -> CAN2BT	0x78
LED state response	CAN2BT -> SD*	0x87

* SD = Smart Device, a phone or a tablet

Table 5 – Proprietary SPP message types

5.2.1. CAN messages

CAN frame format, StdID (ID bit 11 = RTR flag, bits 10 to 0, StdID)						
<ID 0>	<ID 1>	<len>	<D0>	<D1>	...	<D len-1>

CAN frame format, ExtID (ID bit 31 = RTR flag, bits 28 to 0, ExtID)							
<ID 0>	<ID 1>	<ID 2>	<ID 3>	<len>	<D0>	<D1>	<D len-1>

5.2.2. MAP access

J1939 MAP access (data types: 1=u8, 2=u16, 4=u32, 5=f32)								
<Remote node addr>	<SP A0>	<SP A1>	<SP A2>	<data type>	<SP D0>	<SP D1>	<SP D2>	<SP D3>

5.2.3. Configuration messages

Configuration mode (d0 ... d5 are single digits of the PIN code set using command 0x21)							
Enter config mode	0xC0	<d0>	<d1>	<d2>	<d3>	<d4>	<d5>
Exit config mode	0xC1						

CAN Rx Filters									
Add CAN Filter	0x01	<filter b0>	<filter b1>	<filter b2>	<filter b3>	<mask b0>	<mask b1>	<mask b2>	<mask b3>
Remove CAN Filter	0x02	<filter b0>	<filter b1>	<filter b2>	<filter b3>				
Enter promiscuous mode	0x03								
Exit promiscuous mode	0x04								

CAN bus configuration (br index = 0-50k, 1-100k, 2-125k, 3-250k, 4-500k, 5-1M, state = 0-off, 1-on)		
CAN bus baudrate	0x05	<br index>
Set BT CAN TX echo	0x06	<state>

Connection functions		
Scan available devices	0x10	
Connect to remote device	0x11	<scan index>
Disconnect from remote device	0x12	
Set autoconnect	0x13	<scan index>
Define accepted BD ADDR	0x14	<scan index, 0 = currently connected device>
Disable autoconnect	0x15	

PIN Codes (o0...o5 are single digits of the <i>OLD</i> PIN code and n0...n5 are single digits of the <i>NEW</i> PIN)													
Set Pairing PIN Code	0x20	<o0>	<o1>	<o2>	<o3>	<o4>	<o5>	<n0>	<n1>	<n2>	<n3>	<n4>	<n5>
Set Config PIN Code	0x21	<o0>	<o1>	<o2>	<o3>	<o4>	<o5>	<n0>	<n1>	<n2>	<n3>	<n4>	<n5>
Set Rem.Acc. PIN Code	0x22	<o0>	<o1>	<o2>	<o3>	<o4>	<o5>	<n0>	<n1>	<n2>	<n3>	<n4>	<n5>

Data logging (when defining ID, bit 31 = ExtID, bit 30 = RTR, bits 29-0 define the ID)					
Define PGN to log	0x30	<PGN 0>	<PGN 1>	<PGN 2>	<PGN 3>
Define SrcAddress to log	0x31	<Src Address>			
Define ID to log	0x32	<ID 0>	<ID 1>	<ID 2>	<ID 3>
List current rules	0x33				
Erase all rules	0x34				

Flash functions					
Erase all flash data	0x40				
Erase specific flash blocks	0x41	<start blk b0>	<start blk b1>	<end blk b0>	<end blk b1>
Set flash address	0x42	<block b0>	<block b1>	<page b0>	<page b1>

RTC (hour=0...23, min&sec=0...59, day=1...31, weekday=1(mon)...7(sun), month=1...12, year=16... (16=2016))								
Get time	0x50							
Set time	0x51	<hour>	<min>	<sec>	<day>	<weekday>	<month>	<year>

LEDs (mode: 0 – default, 1 – use commands, state: 0 – off, 1 - on)							
Set LED mode	0x52	<mode>					

Misc. functions									
SW reset	0xF0	<'r'>	<'e'>	<'s'>	<'e'>	<'t'>			
Start bootloader	0xF1	<'b'>	<'l'>	<'o'>	<'a'>	<'d'>	<'e'>	<'r'>	
Default settings	0xF2	<'d'>	<'e'>	<'f'>	<'a'>	<'u'>	<'l'>	<'t'>	<'s'>
Bluetooth ID	0x60	<chr 1>	...	<chr n>					

5.2.4. Download flash contents

Download flash contents (if start blk=0, end blk=65535, downloading all data)							
<start blk 0>	<start blk 1>	<end blk 0>	<end blk 1>	<start pg 0>	<start pg 1>	<end pg 0>	<end pg 1>

Download flash contents response							
<chunk no#>	<data 0>	<data 1>	...	<data n>			

Download flash contents ACK							
<chunk no#>							

Download flash contents ACK response (status 0:OK, 1:no more data available)							
<status>							

5.2.5. LED commands

LED state (LED #0: Green, LED #1: Red. LED state: 0=off, 1=on)							
<LED no#>	<LED state>						

LED state response (status 0:OK, 1:failed)							
<status>							

6. ECU Setpoints Accessed with the Axiomatic Electronic Assistant

Currently the CAN2BT device does not have any specific setpoints. The Axiomatic Electronic Assistant (later EA) can be used for setting the J1939 NAME parameters when the device is in Interface Mode (when in Bridge Mode, the CAN2BT device is invisible to the EA and to other J1939 devices on the bus).

The CAN bootloader can be started using the EA, when the device is configured to operate in Interface Mode.

7. Accessing Remote Axiomatic ECUs with BT MAP Tool

The CAN2BT device can access the configuration setpoints of other Axiomatic CAN devices connected to the CAN bus. The Android app for this is called the BT MAP Tool, available from Google Play.

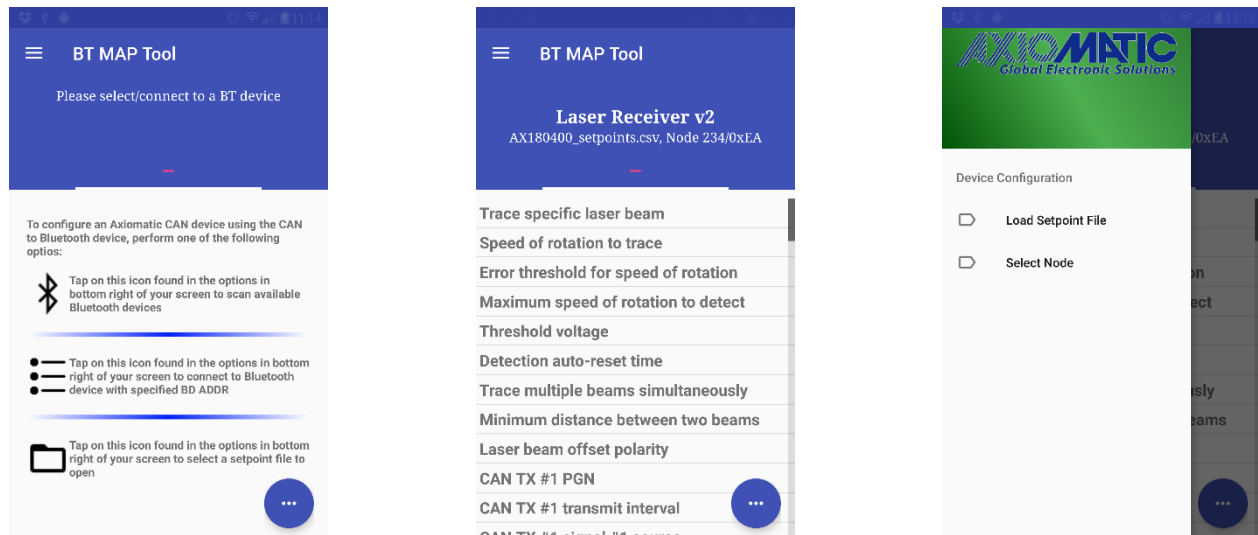


Figure 13 – BT MAP Tool

The BT MAP Tool provides an Axiomatic-EA-like configuration interface to Axiomatic CAN controllers from an Android smart device such as a phone or a tablet.

The BT MAP Tool reads in a setpoint definition file and uses the setpoint addresses and data types specified in that file for accessing the remote Axiomatic CAN device. There are setpoint definition files included in the APK by default, but there are no restrictions of adding more definition files manually.

All Axiomatic CAN controllers that have EA support can be accessed and configured using the BT MAP tool.

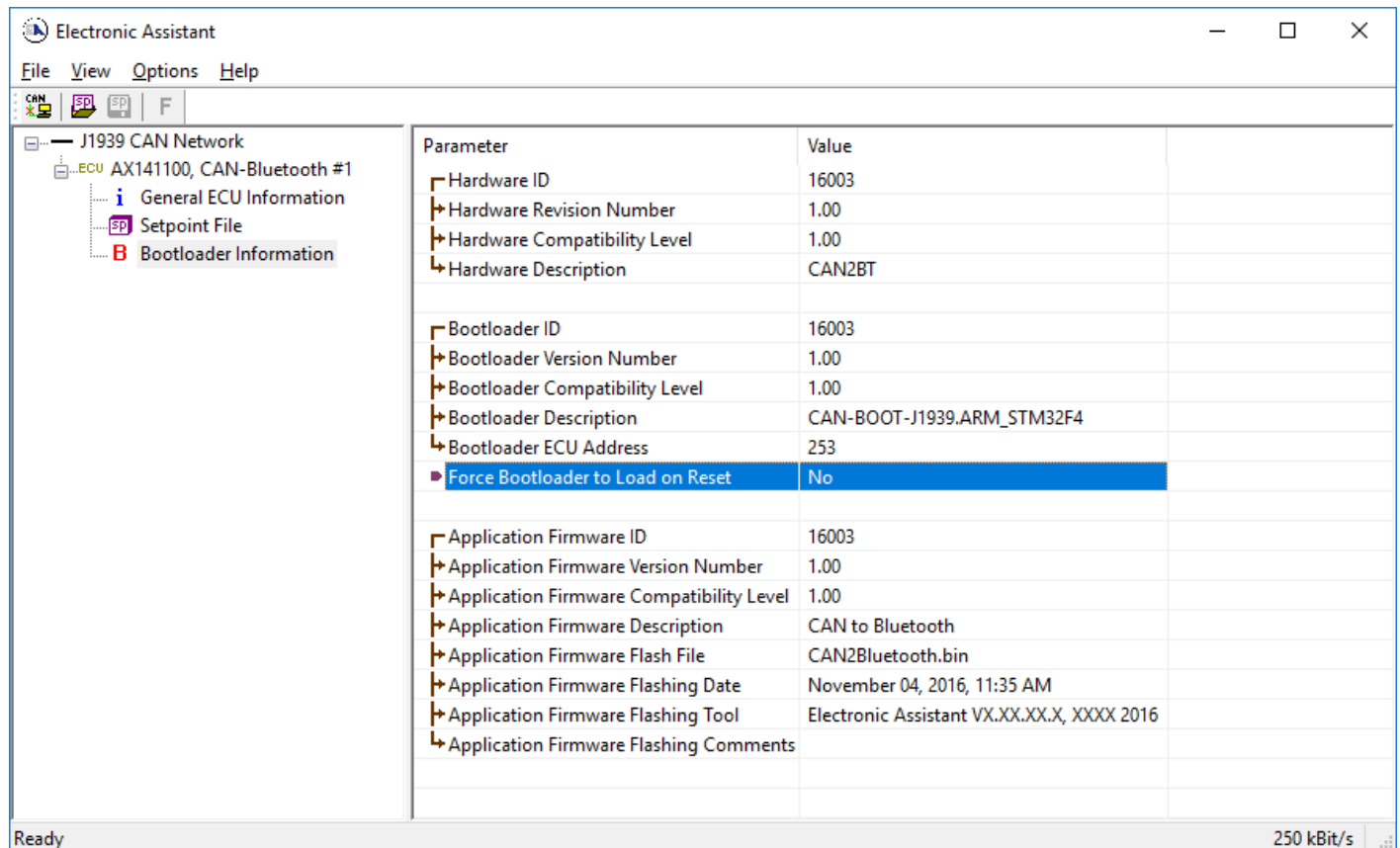
8. Reflashing over CAN with the Axiomatic EA Bootloader

The AX141100 can be upgraded with new application firmware using the **Bootloader Information** section. This section details the simple step-by-step instructions to upload new firmware provided by Axiomatic onto the unit via CAN, without requiring it to be disconnected from the J1939 network.

*Note: To upgrade the firmware use Axiomatic Electronic Assistant V5.13.84.0 or higher. **Further, the AX141100 device needs to be in Interface Mode** (CAN receive filtering enabled) in order to be accessible by the EA.*

Note: In case it is preferred not to set the device to Interface Mode, see Step 3.1 below.

1. When the EA first connects to the ECU, the **Bootloader Information** section will display the following information.

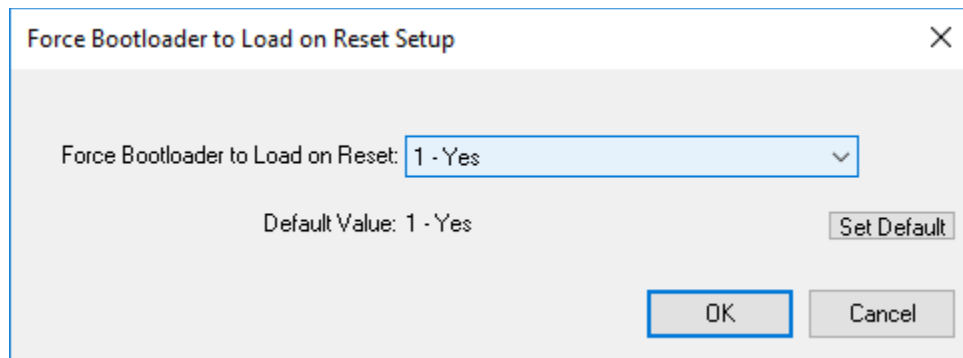


The screenshot shows the Electronic Assistant software window. The left sidebar displays a tree view with the following items: J1939 CAN Network, AX141100, CAN-Bluetooth #1, General ECU Information, Setpoint File, and Bootloader Information (which is selected). The main area displays a table of parameters and their values.

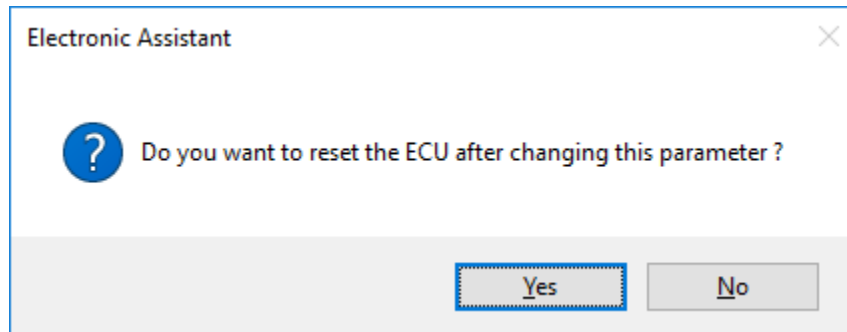
Parameter	Value
Hardware ID	16003
Hardware Revision Number	1.00
Hardware Compatibility Level	1.00
Hardware Description	CAN2BT
Bootloader ID	16003
Bootloader Version Number	1.00
Bootloader Compatibility Level	1.00
Bootloader Description	CAN-BOOT-J1939.ARM_STM32F4
Bootloader ECU Address	253
Force Bootloader to Load on Reset	No
Application Firmware ID	16003
Application Firmware Version Number	1.00
Application Firmware Compatibility Level	1.00
Application Firmware Description	CAN to Bluetooth
Application Firmware Flash File	CAN2Bluetooth.bin
Application Firmware Flashing Date	November 04, 2016, 11:35 AM
Application Firmware Flashing Tool	Electronic Assistant VX.XX.XX.X, XXXX 2016
Application Firmware Flashing Comments	

The status bar at the bottom indicates 'Ready' on the left and '250 kBit/s' on the right.

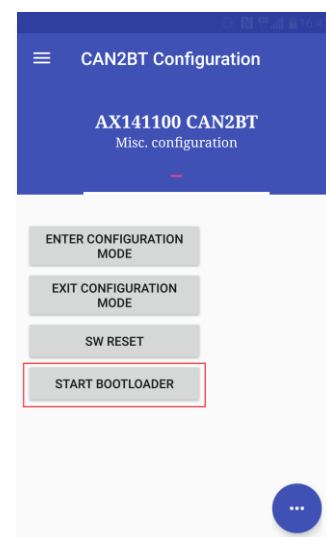
2. To use the bootloader to upgrade the firmware running on the ECU, change the variable “**Force Bootloader To Load on Reset**” to Yes.



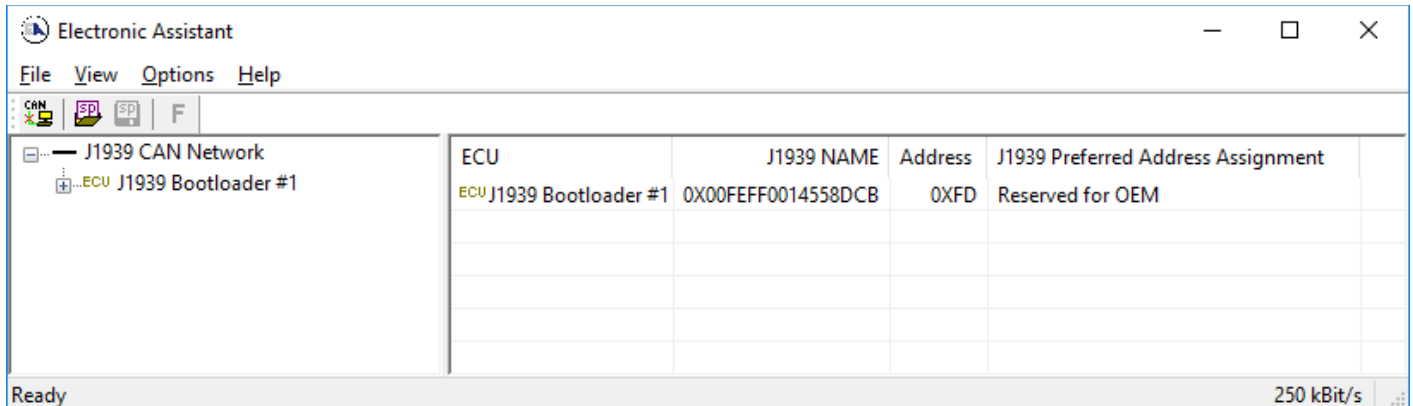
3. When the prompt box asks if you want to reset the ECU, select Yes.



- 3.1 In case the AX141100 device is in Bridge Mode, it cannot be accessed using the Axiomatic EA. In this case, it is possible to start the bootloader from CAN2BLE Configuration tool. First from the *Misc. configuration* menu, the **Configuration Mode** needs to be set active (on left) and then the **Bootloader** can be started (on right).



- Upon reset, the ECU will no longer show up on the J1939 network as an AX141100 but rather as **J1939 Bootloader #1**.



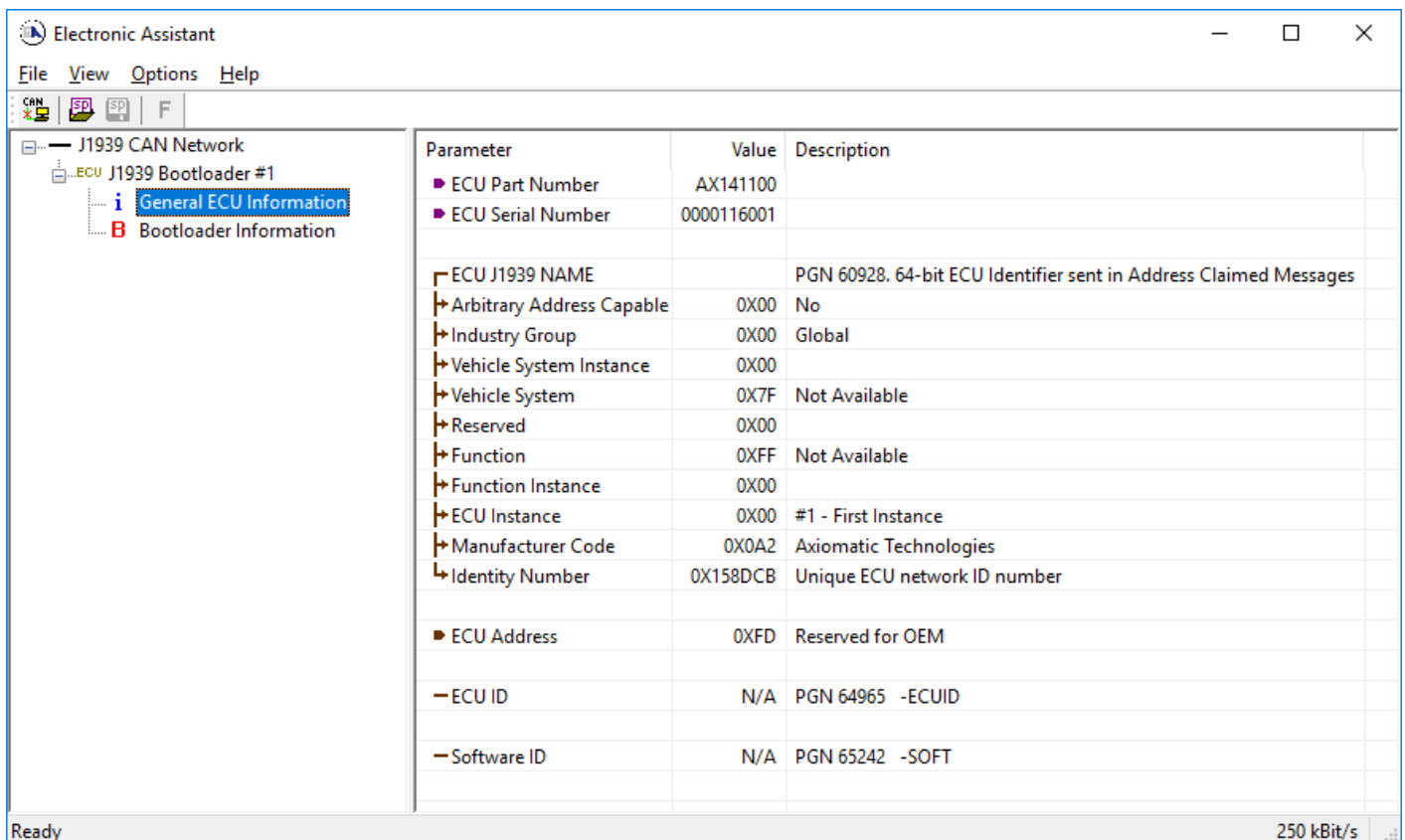
Electronic Assistant

File View Options Help

CAN SP F

ECU	J1939 NAME	Address	J1939 Preferred Address Assignment
ECU J1939 Bootloader #1	0X00FEFF0014558DCB	0XFD	Reserved for OEM

Ready 250 kBit/s



Electronic Assistant

File View Options Help

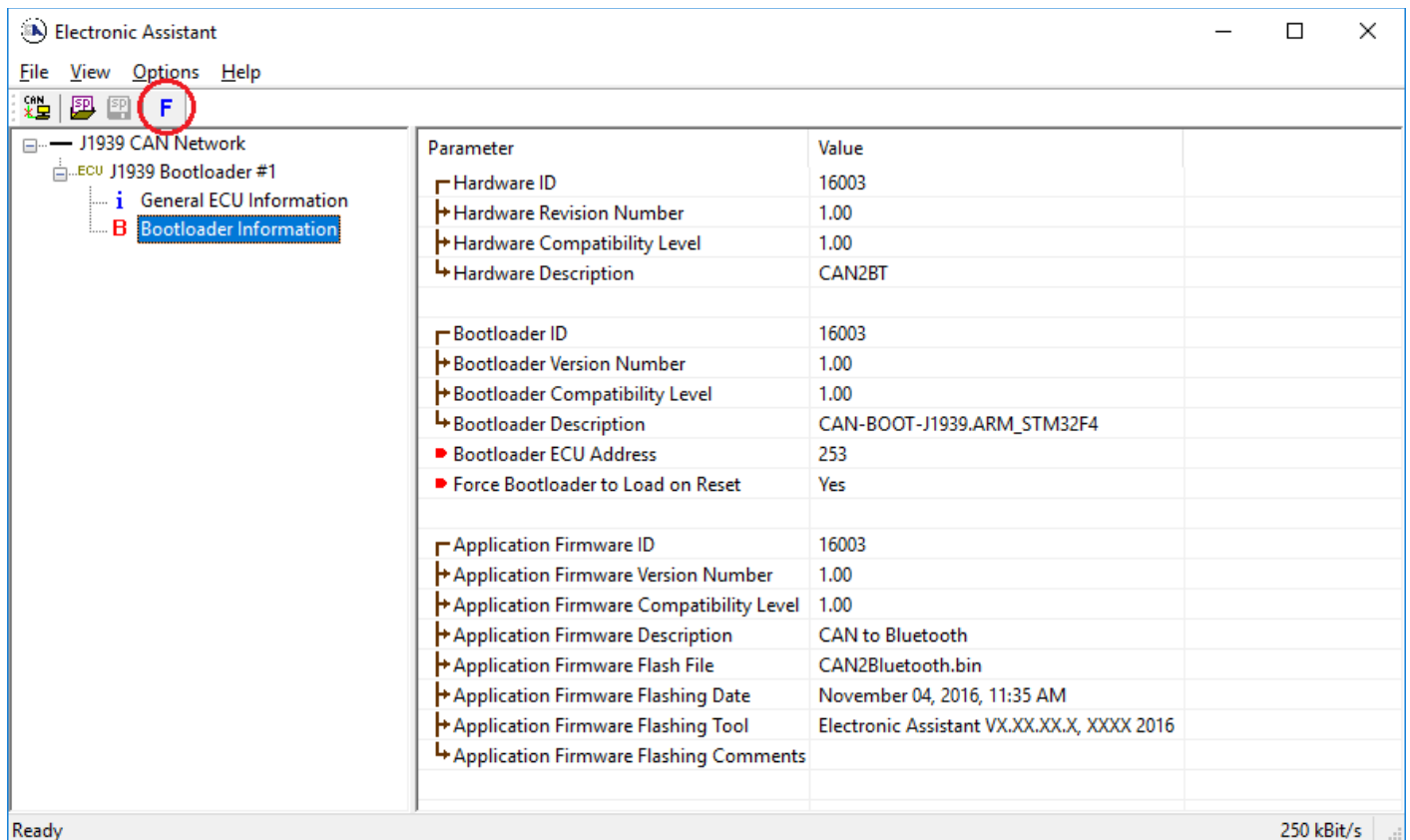
CAN SP F

Parameter	Value	Description
ECU Part Number	AX141100	
ECU Serial Number	0000116001	
ECU J1939 NAME		PGN 60928. 64-bit ECU Identifier sent in Address Claimed Messages
Arbitrary Address Capable	0X00	No
Industry Group	0X00	Global
Vehicle System Instance	0X00	
Vehicle System	0X7F	Not Available
Reserved	0X00	
Function	0XFF	Not Available
Function Instance	0X00	
ECU Instance	0X00	#1 - First Instance
Manufacturer Code	0X0A2	Axiomatic Technologies
Identity Number	0X158DCB	Unique ECU network ID number
ECU Address	0XFD	Reserved for OEM
ECU ID	N/A	PGN 64965 -ECUID
Software ID	N/A	PGN 65242 -SOFT

Ready 250 kBit/s

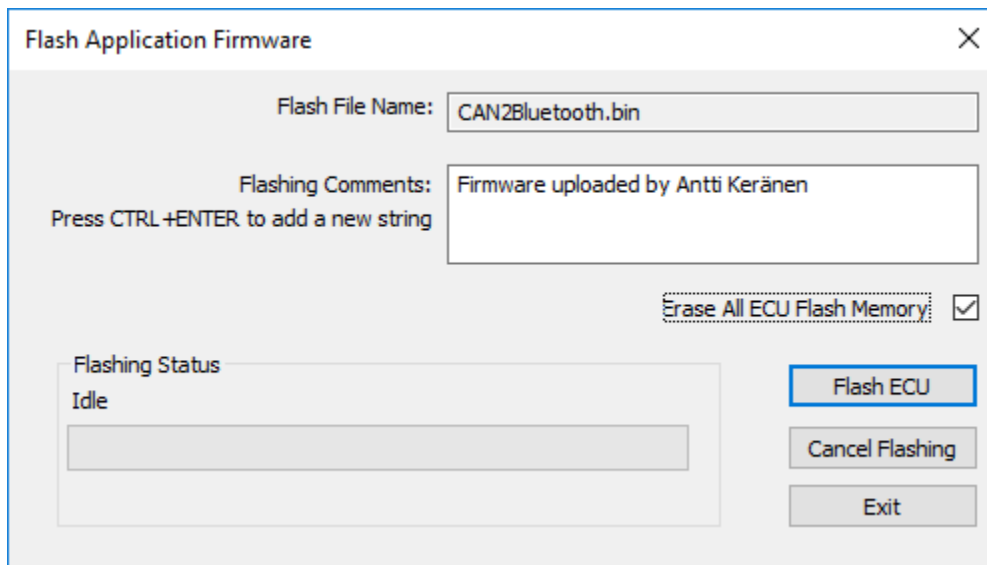
Note that the bootloader is NOT Arbitrary Address Capable. This means that if you want to have multiple bootloaders running simultaneously (not recommended) you would have to manually change the address for each one before activating the next, or there will be address conflicts. And only one ECU would show up as the bootloader. Once the 'active' bootloader returns to regular functionality, the other ECU(s) would have to be power cycled to re-activate the bootloader feature.

- When the **Bootloader Information** section is selected, the same information is shown as when it was running the AX141100 firmware, but in this case the **Flashing** feature has been enabled.



- Select the **Flashing** button and navigate to where you had saved the **CAN2Bluetooth.bin** (or equivalent) file sent from Axiomatic. (Note: only binary (.bin) files can be flashed using the Axiomatic EA tool.)
- Once the Flash Application Firmware window opens, you can enter comments such as "Firmware upgraded by [Name]" if you so desire. This is not required, and you can leave the field blank if you do not want to use it.

Note: You do not have to date/time-stamp the file, as this is done automatically by the Axiomatic EA tool when you upload the new firmware.



Flash Application Firmware

Flash File Name: CAN2Bluetooth.bin

Flashing Comments: Firmware uploaded by Antti Keränen
Press CTRL+ENTER to add a new string

Erase All ECU Flash Memory: ☒

Flashing Status: Idle

Flash ECU

Cancel Flashing

Exit

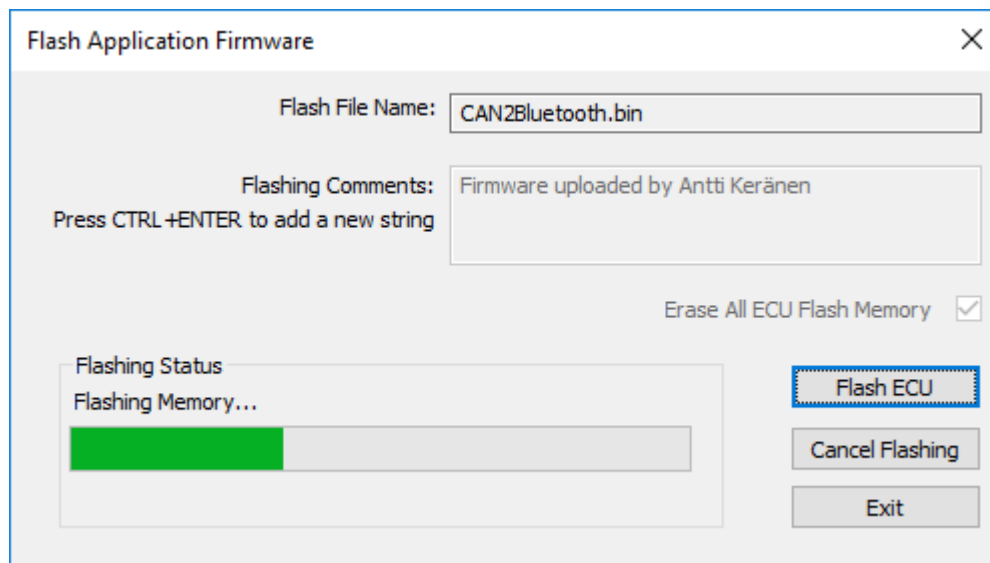
NOTE: If the “Erase All ECU Flash Memory” box is checked, all configuration data currently stored in non-volatile flash including PIN codes will be deleted.



The CAN log data won't be affected by this.

By leaving this box unchecked, none of the settings will be changed when the new firmware is uploaded, unless it is detected by the new firmware that the old settings are incompatible with the new firmware version.

A progress bar will show how much of the firmware has been sent as the upload progresses. The more traffic there is on the J1939 network, the longer the upload process will take.



Flash Application Firmware

Flash File Name: CAN2Bluetooth.bin

Flashing Comments: Firmware uploaded by Antti Keränen
Press CTRL+ENTER to add a new string

Erase All ECU Flash Memory: ☒

Flashing Status: Flashing Memory...

Flash ECU

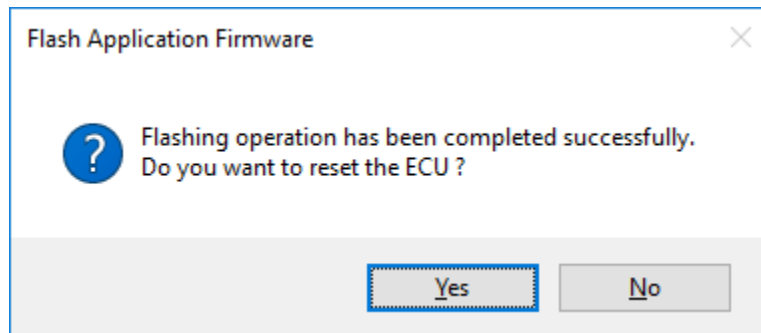
Cancel Flashing

Exit

Once the firmware has finished uploading, a message will pop up indicating the successful operation. If you select to reset the ECU, the new version of the AX141100 application will start

running, and the ECU will be identified as such by the Axiomatic EA. Otherwise, the next time the ECU is power-cycled, the AX141100 application will run rather than the bootloader function.

Note, if the settings define the AX141100 to be configured to operate in Bridge Mode, the device will disappear from the EA upon reset.



Note: If at any time during the upload the process is interrupted, the data is corrupted (bad checksum) or for any other reason the new firmware is not correct, i.e. bootloader detects that the file loaded was not designed to run on the hardware platform, the bad or corrupted application will not run. Rather, when the ECU is reset or power-cycled the **J1939 Bootloader** will continue to be the default application until valid firmware has been successfully uploaded into the unit.

APPENDIX A - TECHNICAL SPECIFICATION

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 Input - Nominal	12Vdc or 24Vdc nominal (8...60 VDC power supply range) Load dump protection is provided.
Protection	Reverse polarity protection is provided. Overvoltage protection up to 88V is provided.
CAN	SAE J1939 CAN bus configuration allows changing the CAN interface baud rate. The list of available baud rate options includes 50 kbps, 100 kbps, 125 kbps, 250 kbps (default), 500 kbps and 1 Mbps.
Bluetooth	TI CC2564MODA Bluetooth® Host Controller Interface Module Bluetooth LE V4.1 compliant Dual-Mode Bluetooth V4.0 with classic Bluetooth and BLE Connection Range*: Up to 50 m (164 ft.) Operating Range*: Up to 150 m (492 ft.) @ 13 dbm (Class 1) Serial Port Profile (SPP) Internal antenna <i>*Range depends on the operating environment and actual results may vary.</i>
Microcontroller	STM32F407VGT7 32-bit, 1024 Kbit program flash
RTC	Real Time Clock back up power 96 hours 4 Gbit Flash Memory
Quiescent Current	15 mA @ 24Vdc Typical
LED Indicator	User configurable
Control Logic	User programmable functionality. Refer to User Manual.
User Interface	CAN2BLE Configuration Application is available for a fee from Google Play for Android devices. It uses Bluetooth® Low Energy (BLE) standard. (https://play.google.com/store/apps/details?id=com.axiomatic.can2bt) CAN2BLE Configuration Application can be downloaded for a fee from Apple's App Store for iOS devices. It uses Bluetooth® Low Energy (BLE) standard. (https://apps.apple.com/us/app/can2ble-configuration/id6478509202). CAN2BT Configuration application is available from Google Play. It uses Bluetooth® Classic. This application is no longer updated. (https://play.google.com/store/apps/details?id=com.axiomatic.can2btconfiguration)
CAN User Interface	Axiomatic Electronic Assistant KIT (P/Ns: AX070502 or AX070506K)
Software Flashing	New software can be flashed over the CAN bus using 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.
Operating Conditions	-30 to 85 °C (-22 to 185 °F)
Protection	IP67
Weight	0.15 lb. (0.06 kg)
Approvals	CE / UKCA marking FCC: Based on TI CC2564MODACMOG compliance - Z64-2564N IC: Based on TI CC2564MODACMOG compliance - 451I-2564N BT SIG: Based on TI CC2564MODACMOG compliance - Bluetooth 4.1 Controller Subsystem Qualified (CC2564MODA: QDID 64631). Compliant up to the HCI Layer
Vibration	MIL-STD-202G, Method 204D test condition C (Sine) and Method 214A, test condition B (Random) 10 g peak (Sine) 7.68 Grms peak (Random)
Shock	MIL-STD-202G, Method 213B, test condition A 50g (half sine pulse, 9ms long, 8 per axis)
Enclosure	Molded Enclosure, integral connector Nylon 6/6, 30% glass, Ultrasonically welded 3.47 x 2.75 x 1.31 inches (88.2 x 70.0 x 33.3 mm) L x W x H including integral connector Refer to the dimensional drawing.

Electrical Connections	<p>Integral 8-pin receptacle (equivalent TE Deutsch P/N: DT04-08PA) 18 AWG wire is recommended for use with contacts 0462-201-16141.</p> <p>A mating plug kit is available. Ordering P/N: AX070112 is comprised of 1 DT06-08SA, 1 W8S, 8 0462-201-16141, and 3 114017.</p> <table border="1" data-bbox="488 264 938 533"> <thead> <tr> <th>PIN #</th><th>FUNCTION</th></tr> </thead> <tbody> <tr><td>1</td><td>CAN_L</td></tr> <tr><td>2</td><td>CAN_H</td></tr> <tr><td>3</td><td>CAN_SHIELD</td></tr> <tr><td>4</td><td>NOT USED</td></tr> <tr><td>5</td><td>NOT USED</td></tr> <tr><td>6</td><td>NOT USED</td></tr> <tr><td>7</td><td>BATT +</td></tr> <tr><td>8</td><td>BATT -</td></tr> </tbody> </table>	PIN #	FUNCTION	1	CAN_L	2	CAN_H	3	CAN_SHIELD	4	NOT USED	5	NOT USED	6	NOT USED	7	BATT +	8	BATT -
PIN #	FUNCTION																		
1	CAN_L																		
2	CAN_H																		
3	CAN_SHIELD																		
4	NOT USED																		
5	NOT USED																		
6	NOT USED																		
7	BATT +																		
8	BATT -																		
Mounting	<p>Mounting holes are sized for #8 or M4 bolts. The bolt length will be determined by the end-user's mounting plate thickness. The mounting flange of the controller is 0.425 inches (10.8 mm) thick. It should be mounted with connectors facing left or right to reduce the likelihood of moisture entry. All field wiring should be suitable for the operating temperature range. Install the unit with appropriate space available for servicing and for adequate wire harness access (6 inches or 15 cm) and strain relief (12 in or 30 cm).</p>																		

Note: Bluetooth® is a registered trademark of Bluetooth SIG.

OUR PRODUCTS

AC/DC Power Supplies
Actuator Controls/Interfaces
Automotive Ethernet Interfaces
Battery Chargers
CAN Controls, Routers, Repeaters
CAN/WiFi, CAN/Bluetooth, Routers
Current/Voltage/PWM Converters
DC/DC Power Converters
Engine Temperature Scanners
Ethernet/CAN Converters,
Gateways, Switches
Fan Drive Controllers
Gateways, CAN/Modbus, RS-232
Gyroscopes, Inclinometers
Hydraulic Valve Controllers
Inclinometers, Triaxial
I/O Controls
LVDT Signal Converters
Machine Controls
Modbus, RS-422, RS-485 Controls
Motor Controls, Inverters
Power Supplies, DC/DC, AC/DC
PWM Signal Converters/Isolators
Resolver Signal Conditioners
Service Tools
Signal Conditioners, Converters
Strain Gauge CAN Controls
Surge Suppressors

OUR COMPANY

Axiomatic provides electronic machine control components to the off-highway, commercial vehicle, electric vehicle, power generator set, material handling, renewable energy and industrial OEM markets. ***We innovate with engineered and off-the-shelf machine controls that add value for our customers.***

QUALITY DESIGN AND MANUFACTURING

We have an ISO9001:2015 registered design/manufacturing facility in Canada.

WARRANTY, APPLICATION APPROVALS/LIMITATIONS

Axiomatic Technologies Corporation reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. 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 at <https://www.axiomatic.com/service/>.

COMPLIANCE

Product compliance details can be found in the product literature and/or on axiomatic.com. Any inquiries should be sent to sales@axiomatic.com.

SAFE USE

All products should be serviced by Axiomatic. Do not open the product and perform the service yourself.



This product can expose you to chemicals which are known in the State of California, USA to cause cancer and reproductive harm. For more information go to www.P65Warnings.ca.gov.

SERVICE

All products to be returned to Axiomatic require a Return Materials Authorization Number (RMA#) from rma@axiomatic.com. Please provide the following information when requesting an RMA number:

- Serial number, part number
- Runtime hours, description of problem
- Wiring set up diagram, application and other comments as needed

DISPOSAL

Axiomatic products are electronic waste. Please follow your local environmental waste and recycling laws, regulations and policies for safe disposal or recycling of electronic waste.

CONTACTS

Axiomatic Technologies Corporation
1445 Courtneypark Drive E.
Mississauga, ON
CANADA L5T 2E3
TEL: +1 905 602 9270
FAX: +1 905 602 9279
www.axiomatic.com
sales@axiomatic.com

Axiomatic Technologies Oy
Höytämöntie 6
33880 Lempäälä
FINLAND
TEL: +358 103 375 750
www.axiomatic.com
salesfinland@axiomatic.com