CAN-Bluetooth® Beacon Gateway

USER MANUAL

P/N: AX141156

VERSION HISTORY

Version	Date	Author	Modification
1.0.0	Mar. 3, 2025	Weixin Kong	Initial Version
1.0.1	Apr. 14, 2025	M Ejaz	Marketing review Updated block diagram and dimensional drawing
-	June 20, 2025	Amanda Wilkins	Final dimensional drawing, final compliance

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

Note:

An Axiomatic Electronic Assistant KIT may be ordered as P/N: AX070502 or AX070506K

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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

TDAX141156 Technologies　　　Technical Datasheet, CAN-Bluetooth® Beacon Gateway, Axiomatic

UMAX07050x Technologies　　　User Manual, Axiomatic Electronic Assistant and USB-CAN, Axiomatic

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 version 5.13.97.0 and higher.

DEFAULT PIN CODES
Configuration mode: 000000
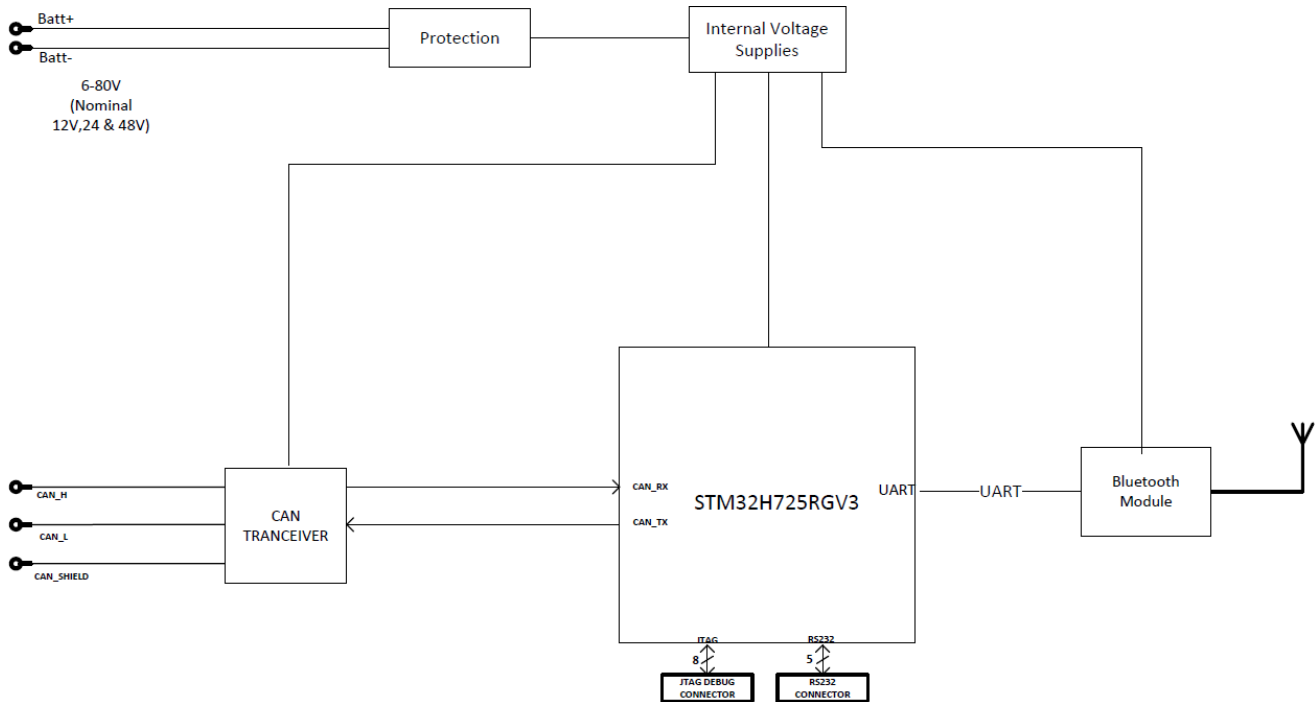
1. Overview of The Controller

Figure 1 – AX141156 Block Diagram

The CAN to Bluetooth Beacon device (CAN2BLE-BCN) enables the reception of BLE beacon messages and their transmission over the CAN Bus. It supports up to eight beacons simultaneously.

The CAN2BLE-BCN device can be configured using the CAN2BLE Configuration app, available on both the Google Play Store and Apple App Store. This application enables users to manage all device functionalities, including setting PIN codes, configuring beacons, and defining forwarding rules.

The primary goal of this project is to forward Bluetooth beacon messages to the CAN Bus. Users can configure specific bytes from the beacon frames or transmit the entire frame. If the beacon frame exceeds 8 bytes, it will be forwarded using J1939 TP.

2. ECU Configuration

This section elucidates the diverse functions and configurations accessible on the CAN2BLE-BCN. The *CAN2BLE Configuration* application is used as a reference. This application can be obtained from both the Google Play Store and the Apple App Store.
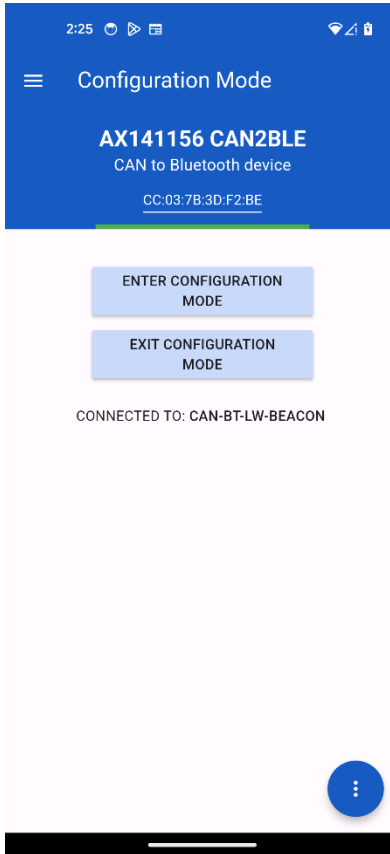
2.1. Configuration mode

Figure 2- Configuration mode settings

The Configuration mode settings change the CAN2BLE-BCN device's mode of operation between configuration mode and normal mode.

The **Enter Configuration** mode requires the user to enter the current Configuration PIN number. In case the smart device is disconnected from the CAN2BLE-BCN device during configuration, the CAN2BLE-BCN device automatically exits the confitguration mode.

Most of the configuration options described in the following sub sections require the device to have the configuration mode active.

ℹ️ **DEFAULT PIN CODES**
Pairing: 000000
Configuration mode: 000000
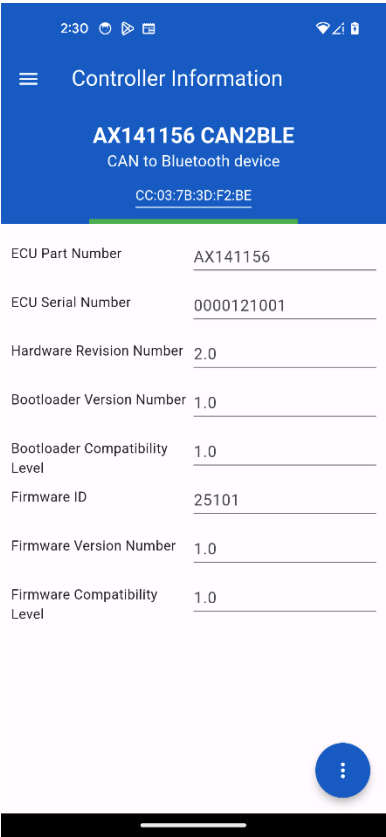

2.2. Controller Information

Figure 3 Controller Information

The controller information section displays ECU details, including the ECU Part Number, Serial Number, Hardware Revision Number, Bootloader Version Number, Bootloader Compatibility Level, Firmware ID, Firmware Version Number, and Firmware Compatibility Level.
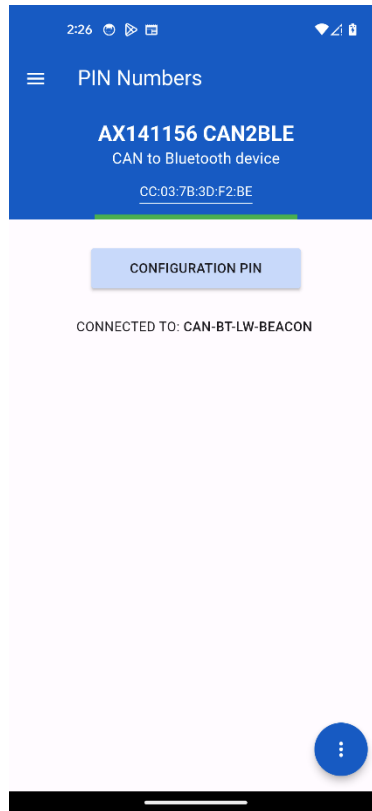
2.3. PIN codes

Figure 4 – 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 CAN2BLE-BCN device with a new smart device. **Configuration PIN** code is required when configuration is accessed (most configuration options require that the CAN2BLE-BCN 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 CAN2BLE-BCN makes a connection with another CAN2BLE-BCN device (when forming a data brigde for wireless CAN communications).

> **DEFAULT PIN CODES**
> **Pairing: 000000**
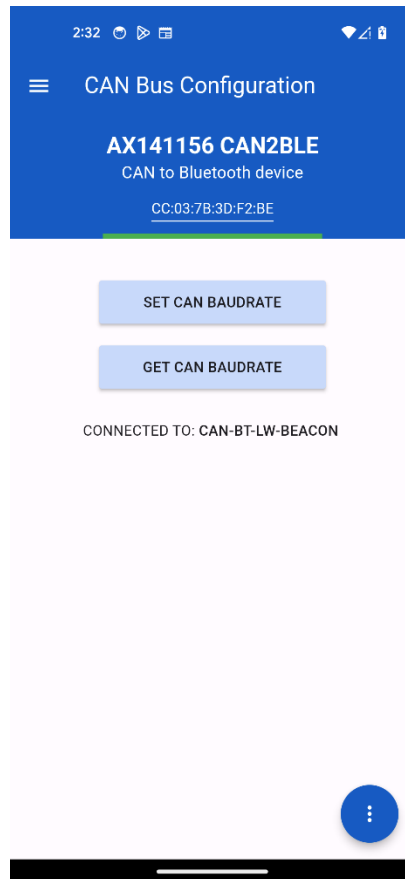> **Configuration mode: 000000**

2.4. CAN Bus Configuration

Figure 5 – CAN bus configuration

CAN bus configuration allows changing the CAN interface baud rate. The list of available baud rate options includes Auto, 20k, 50k, 100k, 125k, 250k (default), 500k and 1M. When changing the baud rate, the CAN2BLE-BCN device needs to be restarted (power cycled) to apply the new baud rate to the CAN interface.
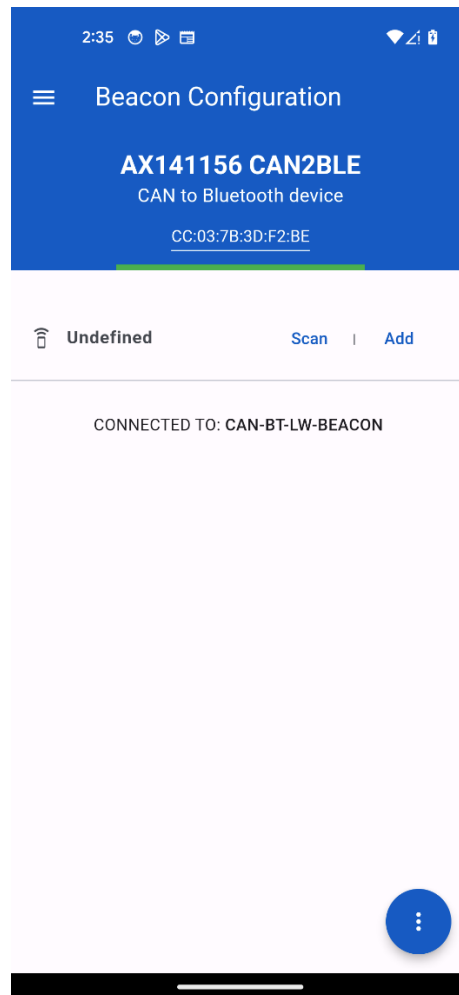
2.5. Beacon Configuration

Figure 6 – Beacon Configuration

Adding new Beacon

When adding a new beacon, users have two options:

Scan – Users can scan for available beacons using the app and select a detected device.

Add (Manual Entry) – If the desired beacon does not appear in the scan results, users can manually add it by entering its Bluetooth device address.
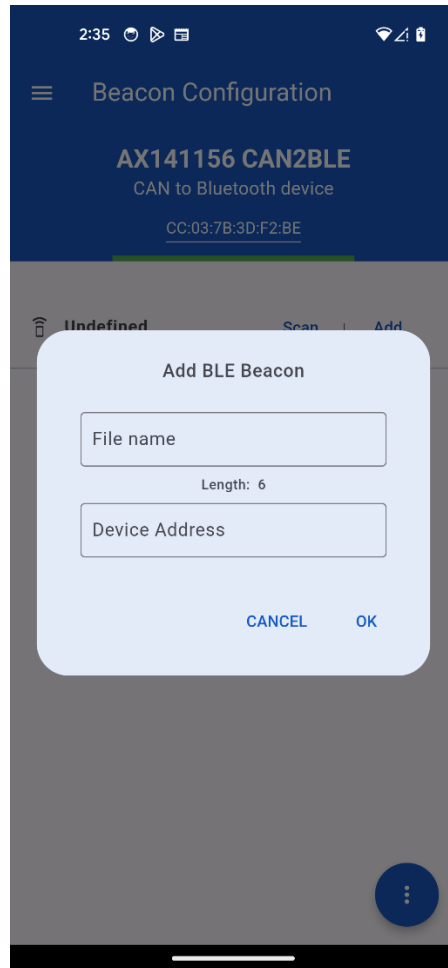
Figure 7 - Adding new Beacon Manual Entry

When adding a beacon manually, users must ensure the Bluetooth device address is entered correctly, as it is unique to each device. Since the address is unique, the beacon's name serves as a reference and can be customized. Users can assign a different name from the beacon's actual name or use the same name for multiple beacons.

Edit/Remove Beacon

Figure 8 - Edit/Remove Beacon

After adding a beacon, users can freely edit its details. They can modify the beacon's name and device address as needed. Additionally, users can remove a beacon from the list by tapping the Remove button.

Configure Beacon

By tapping a beacon in the list, users can access its configuration details for further customization.
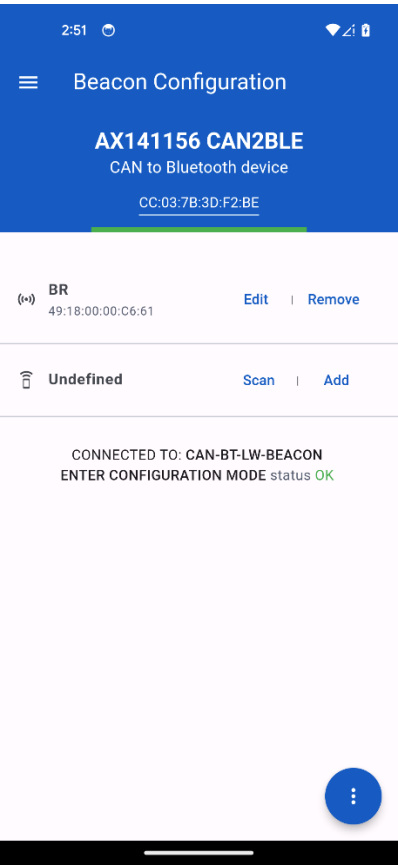

Figure 9 - Configure Beacon

Users can tap on the **"SAMPLE FRAME"** button to view the sample frame broadcasted by the Bluetooth beacon.

When a beacon is configured, the ECU scans for it using its Bluetooth device address and stores the first beacon frame it receives. This feature allows users to retrieve that initial beacon frame for reference when configuring the beacon or CAN Tx settings. The sample frame is captured only once, upon receiving the first message from the beacon, and remains unchanged throughout the beacon instance's lifecycle. If the beacon instance is deleted from the ECU, the stored sample frame is also removed.

Users can choose to use either the entire beacon message frame or a partial frame as the data source. When selecting the full frame, they can apply delimiters and the Filter/Mask function to refine the desired data.

Delimiter Function

Enabling the delimiter allows the controller to extract data preceding the specified delimiter character.

For example, if the beacon frame is:

'A'	'B'	'C'	'D'	','	'E'	'F'	'G'

And the delimiter is ',', the extracted data will be:

'A'	'B'	'C'	'D'

Filter/Mask Function

The Filter/Mask function enables users to extract specific data that follows a defined filter sequence.

For example, given the beacon message frame:

0x13	0xFF	0x00	0x01	0x80	0xEA	0xCA	0x12	0xD9	0x61	0x00	0x00	0x00	0x00	0x85	0x09	0x00	0x00	0x5F	0x01

If the user sets:

- **Filter**: 0x12, 0xD9, 0x61

- **Mask**: 0xFF, 0xFF, 0xFF

And the extracted data will be

0x00	0x00	0x00	0x00	0x85	0x09	0x00	0x00	0x5F	0x01

The system will extract the data that follows this filtered sequence, allowing users to process only the relevant portion of the beacon message. Please note that the filter and mask max length is 8 bytes and filter and mask must be equal length.

Beacon Signals

Figure 10 - Beacon Signal Configuration

When users choose to use a partial frame, the beacon signal feature is activated. Users can specify the signal size and select the start byte/bit to extract the desired data. Each signal can have a maximum data length of 32 bits, and each beacon supports up to four signals.

The **Auto Reset Timer** is a configurable timer, measured in seconds, that determines how long the beacon signal remains valid before resetting. If no new beacon data is received within the set time, the signal is automatically cleared.

2.6. CAN Transmit Configuration

The CAN2BLE-BCN supports up to 32 CAN Transmit messages, each configurable with a different PGN and linked to a specific beacon. Each CAN Transmit can include up to four signals, with each signal mapped to a beacon signal. Users have the flexibility to combine signals from different beacons into a single CAN message.

Additionally, CAN Transmit supports J1939 TP for handling larger messages. However, when J1939 TP is enabled, CAN Signals cannot be configured or used.

Figure 11 - CAN Transmit Configuration

Figure 12- CAN Transmit Signals
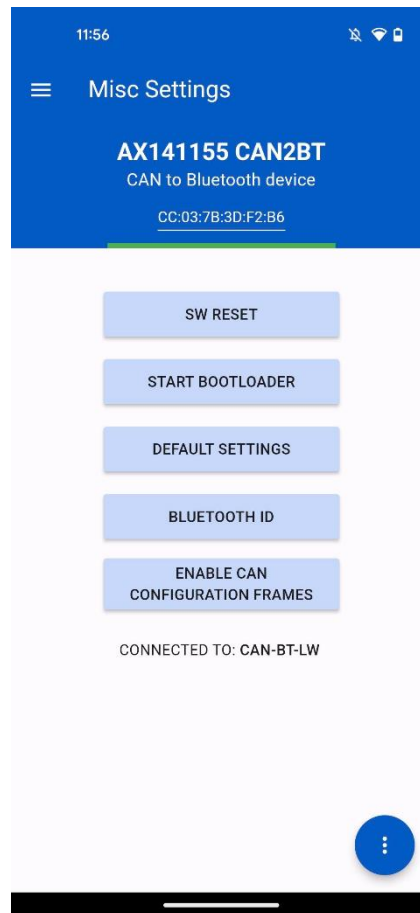
2.7. Miscellaneous Settings

Figure 13 – Miscellaneous settings

The miscellaneous settings consist of resetting the CAN2BLE-BCN device. Also the CAN bootloader can be started for firmware updates (please also see section 6).

SW Reset will reset the CPU of the CAN2BLE-BCN device. **Start bootloader** will set the start bootloader flag and then reset the CPU. This makes the CAN2BLE-BCN 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 6 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 "CAN-BT-LW". In case there are multiple CAN2BLE-BCN devices in range, it might be advantageous to configure unique names to different controllers. The Bluetooth ID accepts charaters 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 CAN2BLE-BCN device is not in configuration mode and the user tries to configure it, the configuration commands return non-zero values.

The "**ENABLE CAN CONFIGURATION FRAMES**" feature facilitates configuring the module via the CAN bus. The AX141156 supports configuration and control using a set of custom CAN messages. Presently, the configuration assumes a default CAN ID of 0x18EF79F1.

3. Installation Instructions

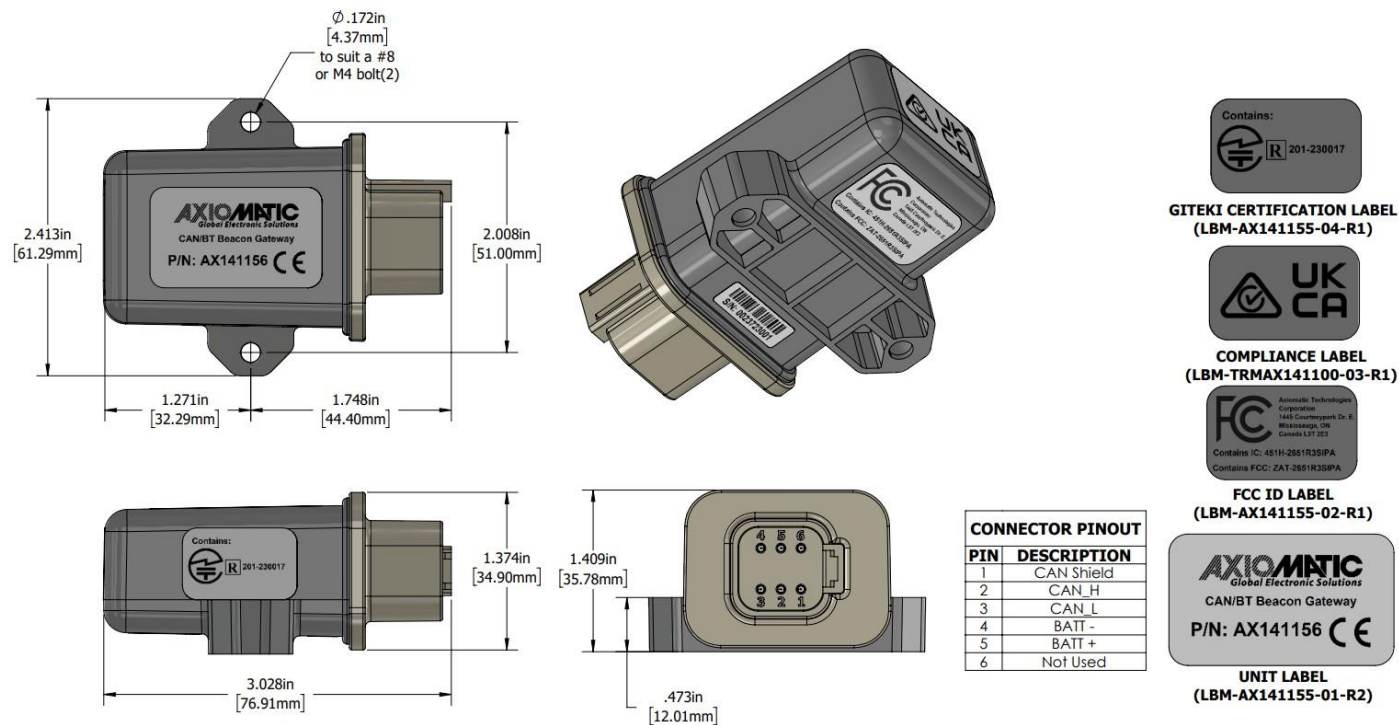## 3.1. Dimensions and Pinout

Figure 14 – AX141156 Dimensional Drawing

PIN #	FUNCTION
1	CAN Shield
2	CAN_H
3	CAN_L
4	BATT -
5	BATT +
6	Not Used

Table 1 – AX141156 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	89, Network interconnect
Function Instance	0, Axiomatic AX141156
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 128 (0x80), which is the default for a generic J1939 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

Smart devices, like phones or tablets, communicate with the CAN2BLE-BCN device through a specialized GATT Service, which has the UUID 2B68C56E-8E48-11E7-BB31-BE2E44B06B34. This service includes four characteristics that facilitate the transfer and reception of data to and from the AX141156, although two of these characteristics are currently inactive. The data within these characteristics is detailed in Table 2

Service 2B68C56E-8E48-11E7-BB31-BE2E44B06B34	
Characteristic UUID	*Description*
2B68C57**0**-8E48-11E7-BB31-BE2E44B06B34	Rx channel for SPP commands
2B68C57**2**-8E48-11E7-BB31-BE2E44B06B34	Not Used
2B68C57**3**-8E48-11E7-BB31-BE2E44B06B34	Not Used
2B68C57**1**-8E48-11E7-BB31-BE2E44B06B34	Tx channel for SPP commands

Table 2 – Available BLE Characteristics

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

Following the receipt of configuration messages, the CAN2BLE-BCN device issues an acknowledgment (ack) response. The general format of the message is outlined below:

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 3 – Overall message format*

Refer to Table 3 for the complete message format. The <msg type> is specified below. The <length> represents the total message length excluding the four CRC32 bytes. CRC32 was chosen due to its widespread support on Android.

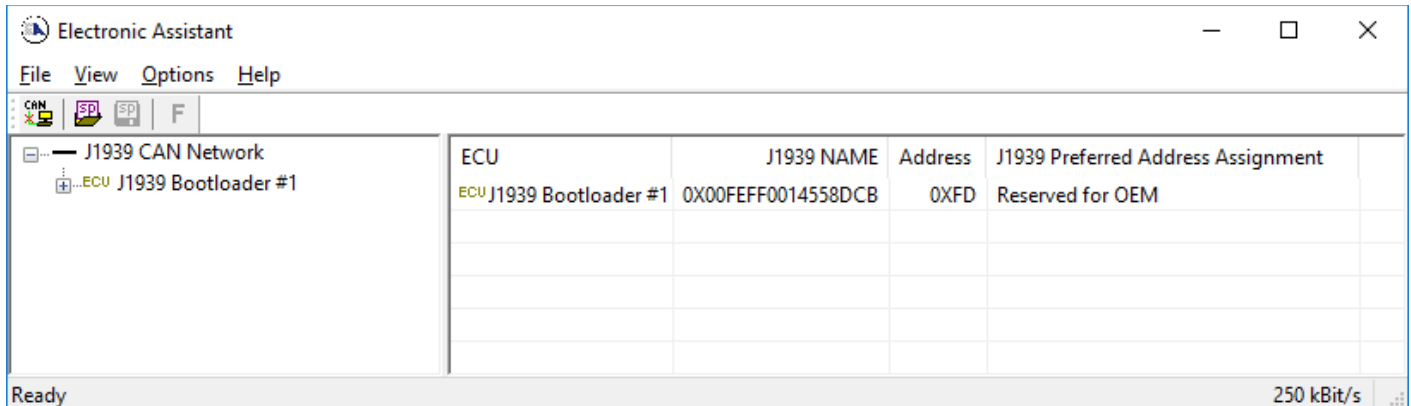## 6. Reflashing over CAN with the Axiomatic EA Bootloader

The AX141156 can be upgraded with new application firmware using the **Start Bootloader** in Misc Setting section in the CAN2BLE Configuration App. 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 V*5.13.97.0 *or higher.* **Further, the AX141156 device will disconnect from Bluetooth once device is in the bootloader**

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).
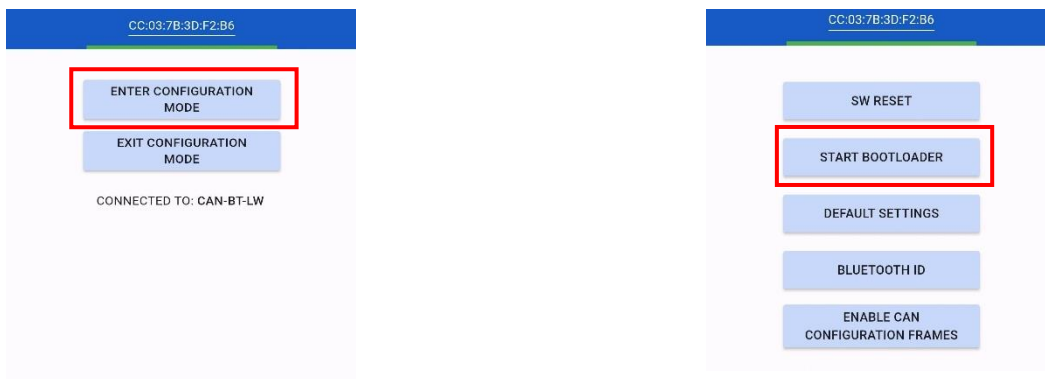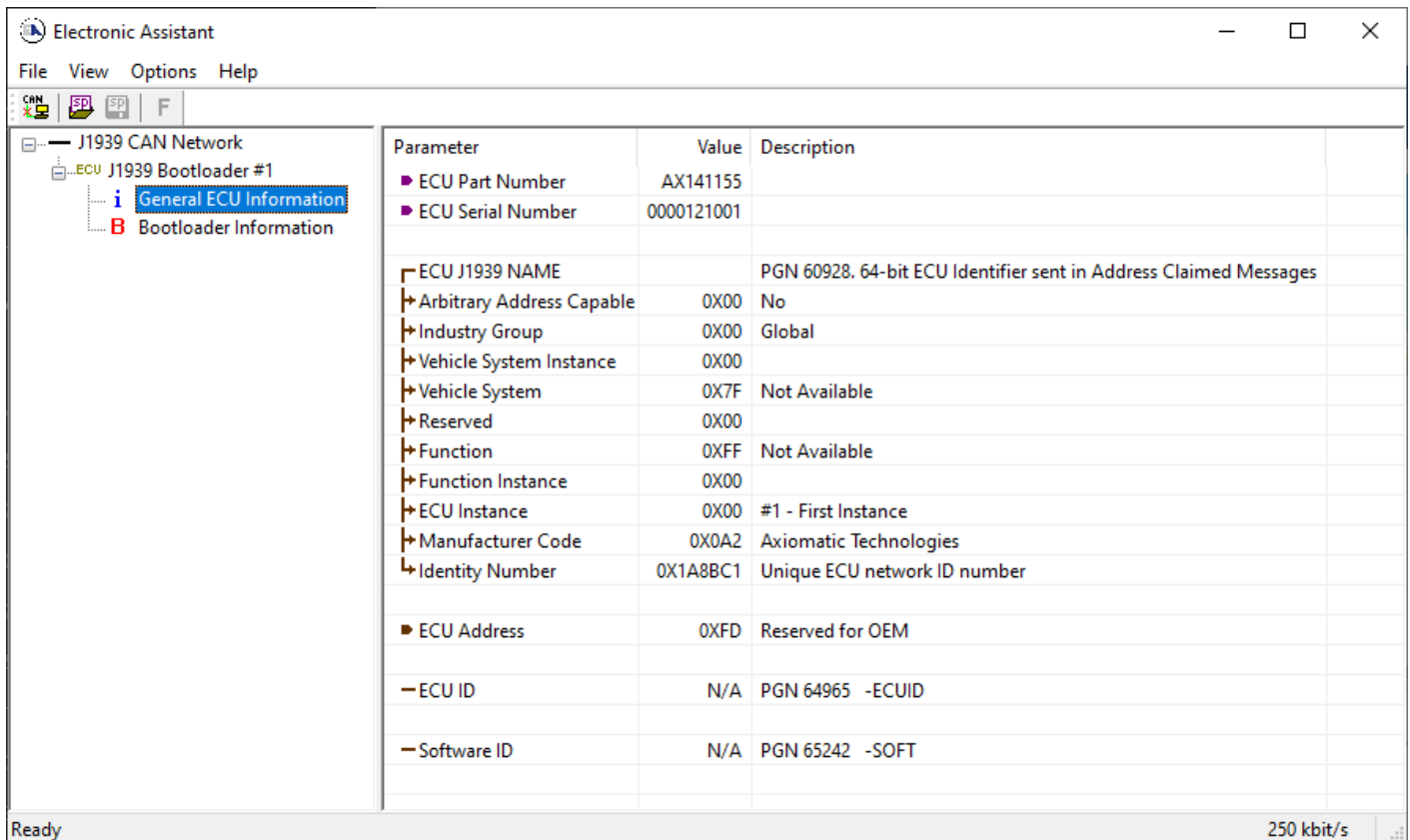
1. Upon reset, the ECU will no longer show up on the J1939 network as an AX141156 but rather as **J1939 Bootloader #1**.

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

Parameter	Value	Description
► ECU Part Number	AX141155	
► ECU Serial Number	0000121001	
⌐ 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	0X1A8BC1	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

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.
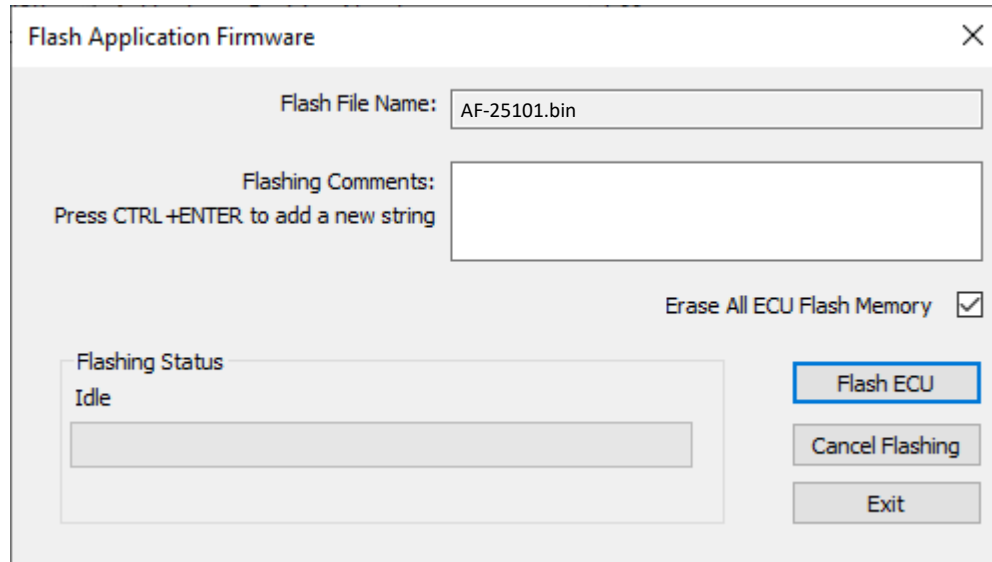
2.   When the **Bootloader Information** section is selected, the same information is shown as when it was running the AX141156 firmware, but in this case the Flashing feature has been enabled.
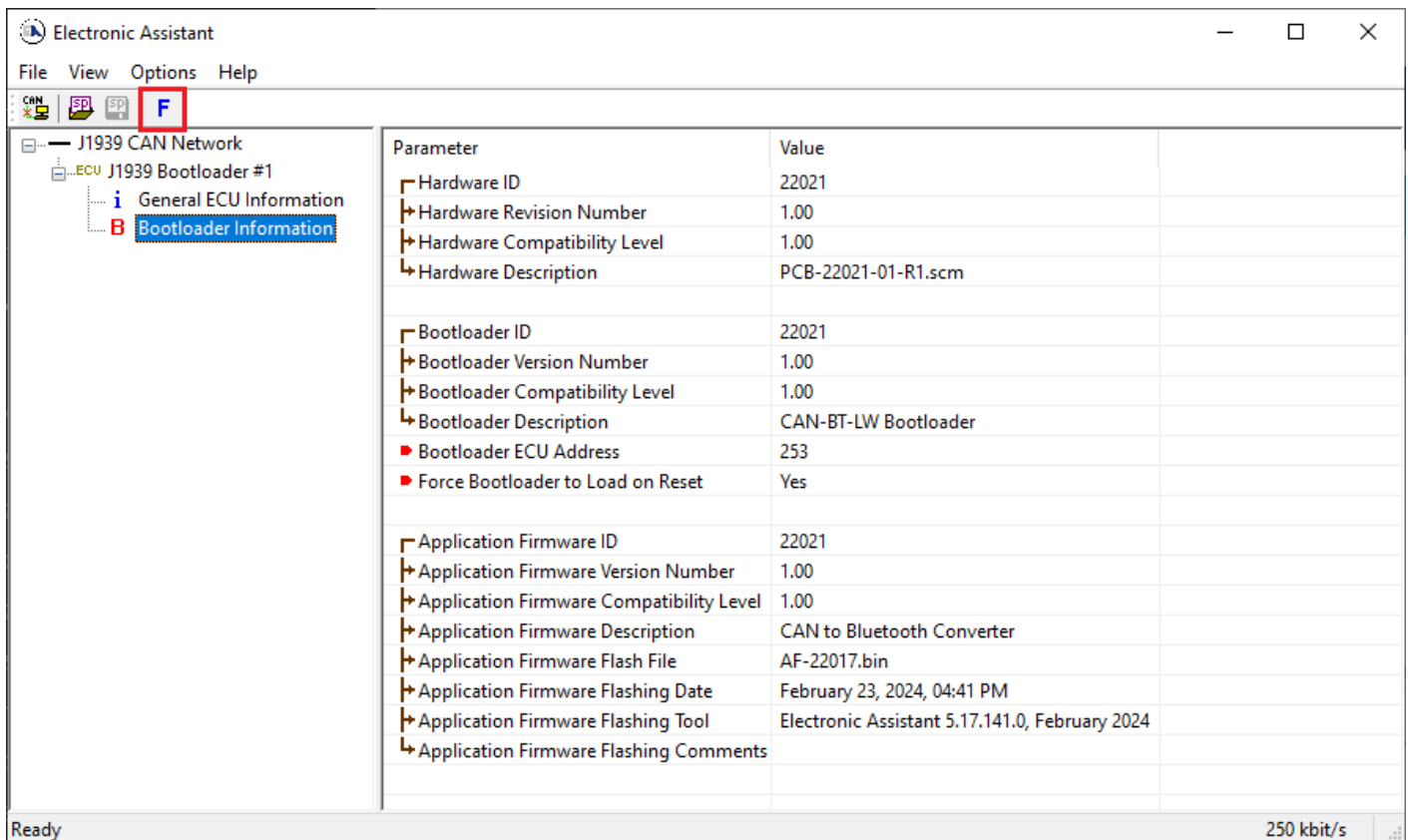
3.   Select the Flashing button and navigate to where you had saved the **CAN2Bluetooth.bin** (or equivalent) file sent from Axiomatic. (Note: only binary (.bin) files can be flashed using the Axiomatic EA tool.)

4.   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.
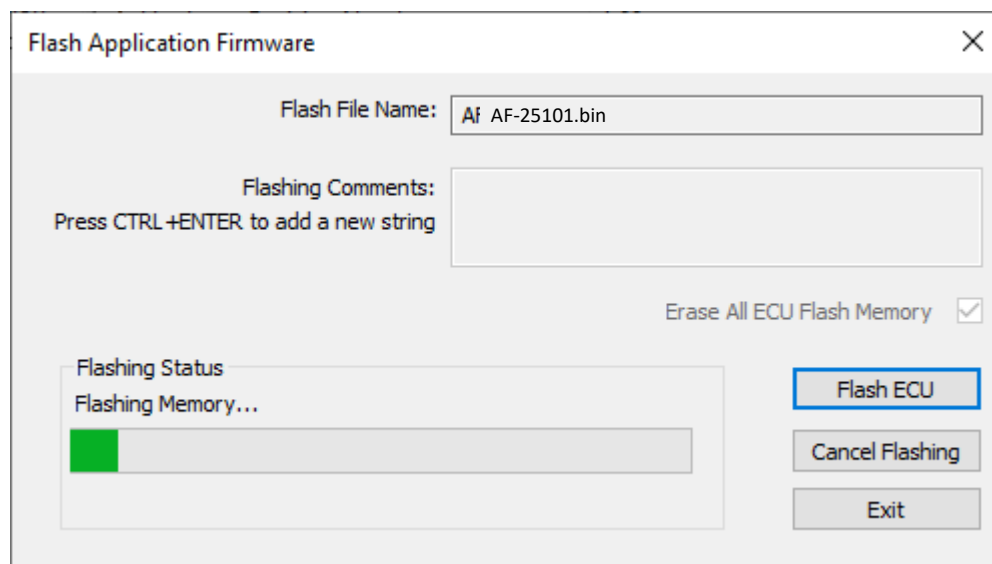

NOTE: If the "Erase All ECU Flash Memory" box is checked, all configuration data currently stored in non-volatile flash including PIN codes will be deleted. By leaving this box unchecked, none of the settings will be changed when the new firmware is uploaded, unless it is detected by the new firmware that the old settings are incompatible with the new firmware version.
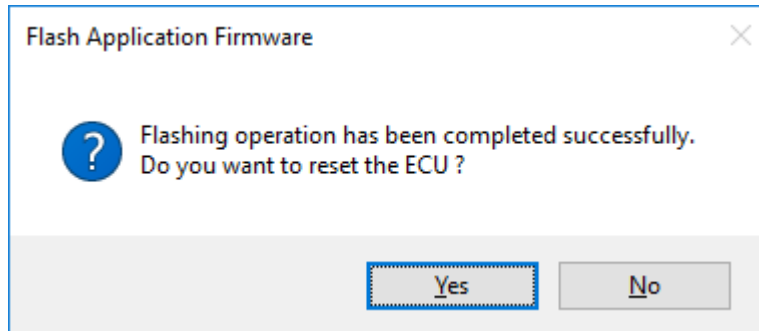
A progress bar will show how much of the firmware has been sent as the upload progresses. The more traffic there is on the J1939 network, the longer the upload process will take.

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 AX141156 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 AX141156 application will run rather than the bootloader function.

Flash Application Firmware ×

? Flashing operation has been completed successfully.
Do you want to reset the ECU ?

[Yes]   [No]

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 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 Limitations & Return Materials Process as described on https://www.axiomatic.com/service/.

Power Supply Input	12Vdc, 24Vdc, or 48Vdc nominal (6 to 80 VDC power supply range)
Quiescent Current	47 mA @ 12 Vdc; 37 mA @ 24 Vdc; 20 mA @ 48 Vdc (Typical)
Protection	Load dump protection is provided. Reverse polarity protection is provided. Overvoltage protection up to 88 V is provided.
Microcontroller	STM32H725RGV3, 32-bit, 1024 kbit flash memory
CAN	1 CAN port (SAE J1939) Baud-rate can be configured. Supported baud-rates include 20, 50, 100, 125, 250 (default), 500, and 1000 kbps with auto-baud-rate detection.
Bluetooth®	TI CC2651R3SIPA Bluetooth® LE V5.2 compliant Serial Port Profile (SPP) Internal antenna Connection Range*: Up to 50 m (164 ft.) Operating Range*: Up to 150 m (492 ft.) @ 13 dbm (Class 1) ***Range depends on the operating environment and actual results may vary.***
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). In addition to the above, Axiomatic Electronic Assistant KIT (P/Ns: AX070502 or AX070506K) may also be used to configure baud-rate.
Operating Temperature	-30°C to 85°C (-22°F to 185°F)
Storage Temperature	-50°C to 125°C (-58°F to 257°F)
Weight	0.1 lb. (0.045 kg)
Approvals	CE / UKCA / Giteki marking TI CC2651R3SIPAT0MOUR Bluetooth® SIG Contains: CE-RED (Europe) Contains: FCC (US) ZAT-2651R3SIPA Contains: ICES (Canada) 451H-2651R3SIPA Contains: Japan (Telec) R201-230017 RoHS
Protection	IP67
Enclosure	Molded enclosure, integral connector Nylon 6/6, 30% glass, laser welded 3.02 in x 2.41 in x 1.41 in (77 mm x 61 mm x 36 mm) L x W x H includes the integral connector. Refer to Dimensional Drawing. Flammability rating: UL 94 HB
Electrical Connections	6-pin connector (equivalent TE Deutsch P/N: DT04-6P) <table><tr><th>Pin</th><th>Description</th></tr><tr><td>1</td><td>CAN Shield</td></tr><tr><td>2</td><td>CAN H</td></tr><tr><td>3</td><td>CAN L</td></tr><tr><td>4</td><td>Power -</td></tr><tr><td>5</td><td>Power +</td></tr><tr><td>6</td><td>Not Used</td></tr></table>
Mating Plug Kit	Axiomatic P/N: **AX070119** (includes 1 plug DT06-6S, 1 wedgelock W6S, and 6 sockets 0462-201-16141)
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.
Mounting	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 in. (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 in. or 15 cm) and strain relief (12 in. or 30 cm).

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

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Signal Conditioners, Converters

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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

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