

# **CAN-Bluetooth® Converter**

## **USER MANUAL**

**P/N: AX141150**

## VERSION HISTORY

Version	Date	Author	Modification
1.0.0.	Mar. 28, 2018	Antti Keränen	Initial Version
1.0.1.	Apr. 29, 2018	Antti Keränen	POLL PGN command updated, CAN receive filtering section updated.
1.0.2.	Sep. 28, 2022	Antti Keränen	New SPP commands added, CAN2BT Configuration app screenshots updated. BLE messaging details added to section 5.2.
1.0.3	Sep. 13, 2023	Kiril Mojsov	Performed Legacy Updates
1.0.4	Mar. 28, 2024	M Ejaz	Updated technical specifications Removed BTMAP references



### **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	The 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

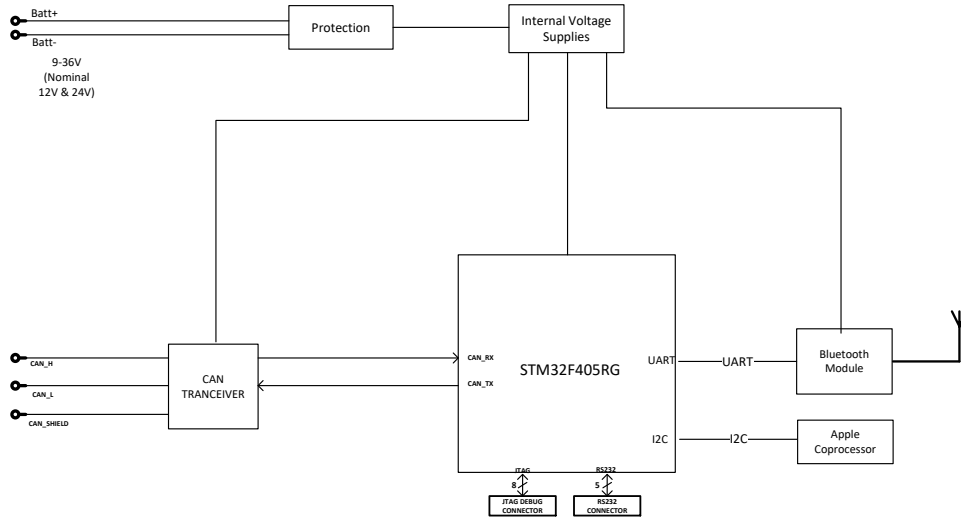
J1939	Recommended Practice for a Serial Control and Communications Vehicle Network, SAE, April 2011
J1939/21	Data Link Layer, SAE, December 2010
J1939/71	Vehicle Application Layer, SAE, March 2011
J1939/73	Application Layer-Diagnostics, SAE, February 2010
J1939/81	Network Management, SAE, May 2003
TDAX141150	Technical Datasheet, CAN to Bluetooth bridge with Apple support, 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 version 5.13.97.0 and higher.

# 1. Overview of The Controller



**Figure 1 – AX141150 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 has Apple authentication co-processor, so it is accessible using Apple iOS devices.

The CAN2BT device can be configured using an Android application called *CAN2BT 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 frame special handling rules.

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 be still accessed using the *CAN2BT 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 failure mode, the unit will be accessible only via the CAN bus.

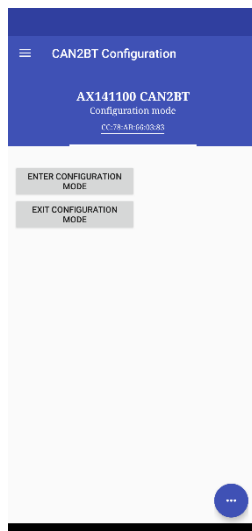
<b>Condition</b>	<b>Lamp</b>	<b>SPN</b>	<b>FMI</b>	<b>OC</b>	<b>Src.Address</b>
BT module failure	MALFUNCTION	3368 (WCM1)	31	1	0xFB (251)



## 2. CAN to Bluetooth Function Blocks

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

### 2.1. Configuration mode



**Figure 2 – Configuration mode settings**

The Configuration mode settings change the CAN2BT 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 CAN2BT device during configuration, the CAN2BT device automatically exits the configuration mode.

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

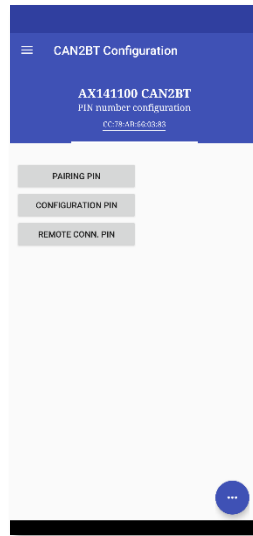


### **DEFAULT PIN CODES**

**Pairing: 000000**

**Configuration mode: 000000**

## 2.2. PIN codes



**Figure 3 – 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).

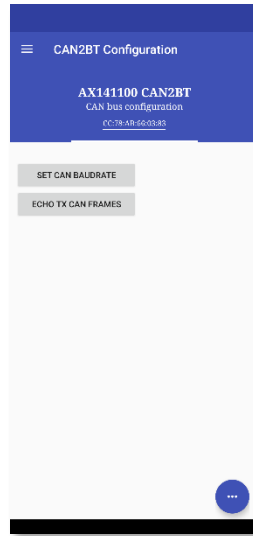


### **DEFAULT PIN CODES**

**Pairing: 000000**

**Configuration mode: 000000**

## 2.3. CAN Bus Configuration

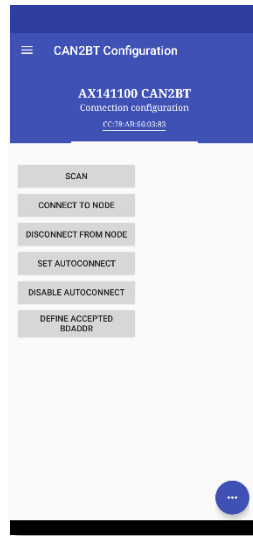


**Figure 4 – CAN bus configuration**

CAN bus configuration allows changing the CAN interface baudrate. The list of available baudrate options include 10k, 20k, 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 for more info about CAN message sending.

## 2.4. Connection Options



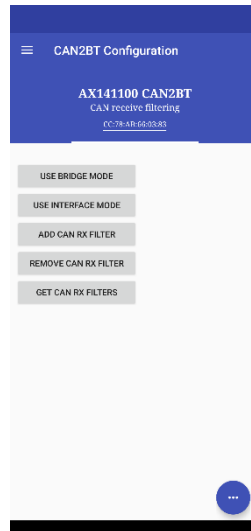
**Figure 5 – Connection options**

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.

## 2.5. CAN Receive Filtering



**Figure 6 – CAN Receive Filtering settings**

By default the device won't read in all received CAN messages. With the CAN receive filtering functions, the user can change this behaviour. **Use Bridge mode** 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.

**Use Interface mode** 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**

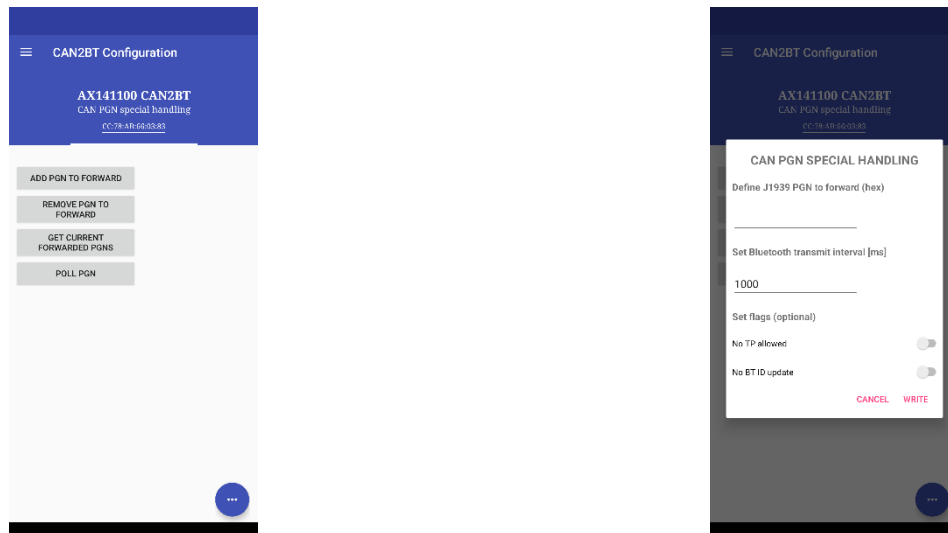
*Example 29bit ID filter & mask for receiving all (J1939) frames with Source Address 0xF9*

Filter:                   , Mask:

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

Filter:                   , Mask:

## 2.6. CAN PGN Special Handling



**Figure 7 – CAN PGN Special Handling settings**

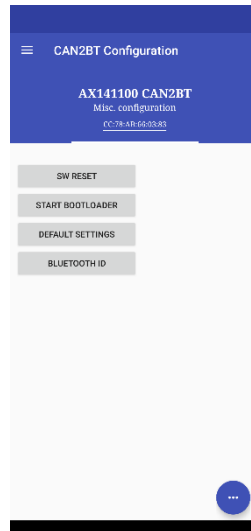
By default the device will pass all CAN frames that match the configured CAN RX filters as soon as received with no content parsing done. In case the message transmit intervals to the direction of the Bluetooth device needs to be slowed down, the CAN PGN Special Handling settings provide a method for this. The **Add PGN to forward** option will allow the user to define a PGN to be received, a Bluetooth transmit interval for it. Also some special options, such as parsing the content of the received set of TP frames and setting the CAN2BT devices Bluetooth ID based on the content of the received CAN message are provided.

The Bluetooth ID accepts characters in range 0x20 ('space') to 0x7E ('~') and can hold up to 248 characters. The CAN content parsing function will automatically drop any received bytes that are outside of that range when the PGN having the BT ID update flag is received.

In case the Allow TP flag is set, the PGN can be wrapped into a set of J1939 TP frames. The parsing function will read the contents and forward those into the Bluetooth device instead of the raw TP frames.

The Poll PGN feature sends out a request PGN frame to the CAN bus. The frame(s) containing the requested PGN are returned to the Bluetooth device on reception. In case the PGN is wrapped into a set of TP frames, either the parsed data or raw frames are returned depending on the current PGN Special handling list configuration. In case the Poll PGN function's Destination Address and Source Address are not specified, these will default to 0xFF as destination address and CAN2BT device's own J1939 address as source address (the default address is 0x80).

## 2.7. Miscellaneous Settings



**Figure 8 – Miscellaneous settings**

The miscellaneous settings consist of resetting the CAN2BT device. Also the CAN bootloader can be started for firmware updates (please also see section 7).

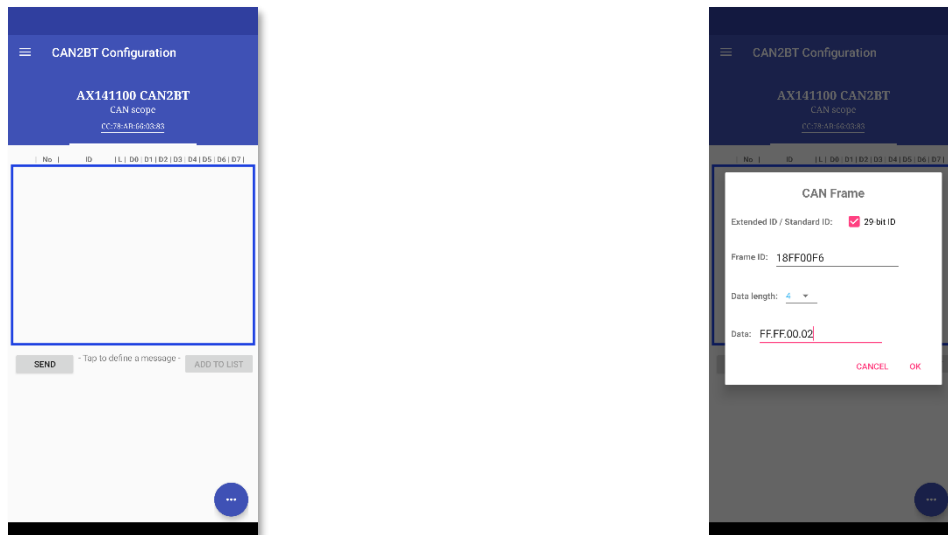
**SW Reset** will reset the CPU of the CAN2BT device. **Start bootloader** will set the start bootloader flag and then reset the CPU. This makes the CAN2BT device enter the firmware reflash mode, and it will be visible on the CAN bus and accessible from the Axiomatic EA as Bootloader #1 (please see section 7 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.

## 2.8. CAN Scope



**Figure 9 – CAN Scope**

The CAN Scope function shows the frames on the CAN bus. Only the frames that pass the receive filters (please see section 2.5) 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:

In case the Data length is set longer than 8 bytes, the outgoing CAN frame will be automatically placed inside J1939 Transport Protocol (later TP) messages. Also, on reception of a TP message that carries a PGN defined in the list of PGNs to be special handled with the TP option, the parsed contents of the message are shown in the Scope instead of the raw TP frames. If the CAN PGN special handling list is not configured, the TP frames will be shown as received (content not parsed).



### 3. Installation Instructions

#### 3.1. Dimensions and Pinout

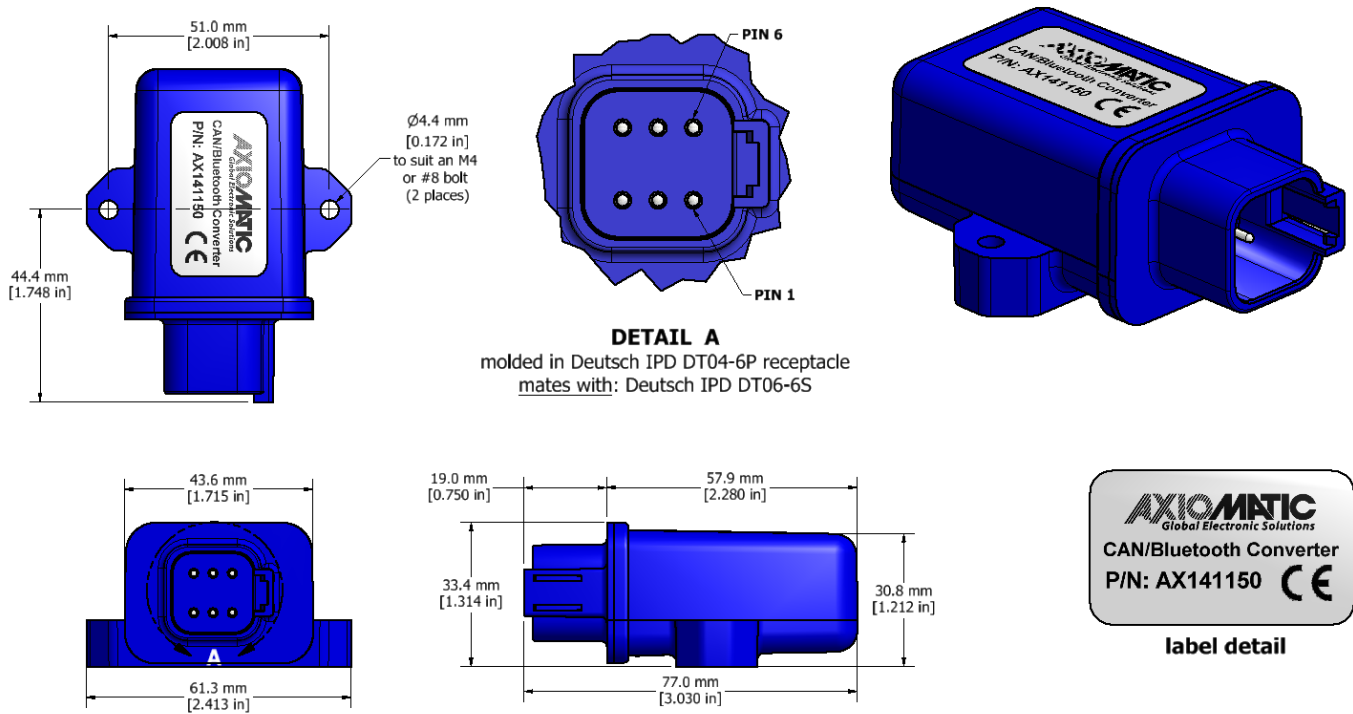


Figure 10 – AX141150 Dimensional Drawing

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

Table 2 – AX141150 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	25, Network interconnect
Function Instance	18, Axiomatic AX141150
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.

<b>(Part Number)*(Version)*(Date)*(Owner)*(Description)</b>
---

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>

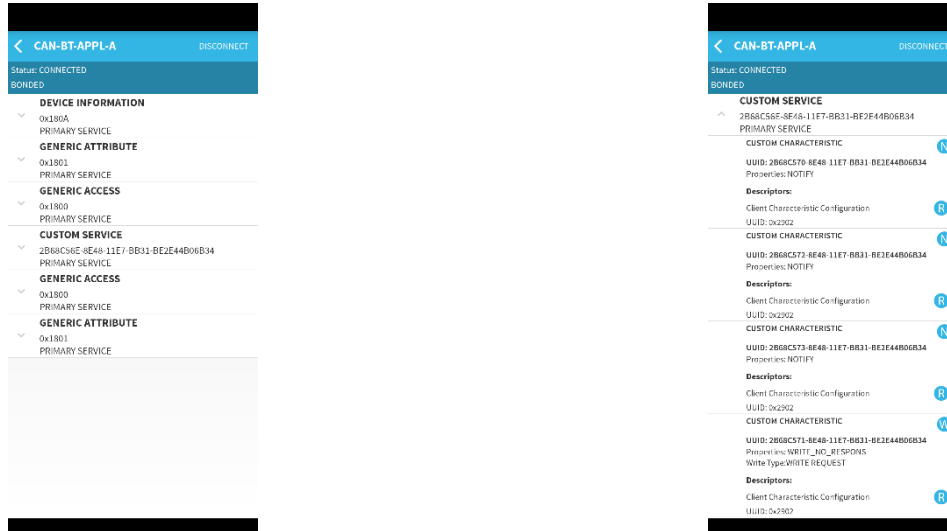
**Table 3 – Overall message format**

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: 1 – 10k, 2 – 20k, 3 – 50k, 4 – 100k, 5 – 125k, 6 – 250k, 7 – 500k, 9 – 1M

## 5.2. BLE communications



**Figure 11 – BLE Services and Characteristics**

In addition to the classic BT data transfers, the AX141150 supports BLE communications using custom GATT service with UUID **2B68C56E-8E48-11E7-BB31-BE2E44B06B34** (left screenshot in Figure 11). The custom service contains four characteristics for receiving and sending data to the AX141150 (right screenshot in Figure 11). The characteristics contain the data described in Table 4.

<b>Service 2B68C56E-8E48-11E7-BB31-BE2E44B06B34</b>	
<i>Characteristic UUID</i>	<i>Description</i>
2B68C570-8E48-11E7-BB31-BE2E44B06B34	Rx channel for SPP commands
2B68C572-8E48-11E7-BB31-BE2E44B06B34	Rx channel for received CAN frame ID
2B68C573-8E48-11E7-BB31-BE2E44B06B34	Rx channel for received CAN payload data
2B68C571-8E48-11E7-BB31-BE2E44B06B34	Tx channel for SPP commands

**Table 4 – Available BLE Characteristics**

### 5.3. Message types (AX141150 specific)

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
Change configuration	SD* -> CAN2BT	0x67
Change configuration response	CAN2BT -> SD*	0x76
POLL/Request PGN	SD* -> CAN2BT	0x89
POLL/Request PGN response	CAN2BT -> SD*	0x98
Multiple CAN Rx frames**	CAN2BT -> SD*	0xFE
Multiple CAN Tx frames**	SD* -> CAN2BT	0xEF

\* SD = Smart Device, a phone or a tablet

\*\* Supported starting from AX141150 firmware v3.00

**Table 5 – Proprietary SPP message types**

#### 5.3.1. New connection notification

Connected to: <configured node name> (default: CAN-BT-APPL)										
<'C'>	<'A'>	<'N'>	<'-'>	<'B'>	<'T'>	<'-'>	<'A'>	<'P'>	<'P'>	<'L'>

#### 5.3.2. CAN messages, single 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. Len > 8 will transmit the message using TP)								
<ID 0>	<ID 1>	<ID 2>	<ID 3>	<len>	<D0>	<D1>	...	<D len-1>

#### 5.3.3. CAN messages, multiple frames combined

Multiple CAN frames, Rx and Tx, ExtID and StdID (n = max 6 frames, individual frames described below)			
<CAN frame #1>	<CAN frame #2>	...	<CAN frame #n>

CAN frame format inside a multi-frame message, StdID							
0x21	<ID LSB>	<ID 3MSBs   bit 8 = RTR>	<len>	<D0>	<D1>	...	<D len-1>

CAN frame format inside a multi-frame message, ExtID									
0x31	<ID LSB>	<ID 1>	<ID 2>	<ID 5MSBs   bit 8 = RTR>	<len>	<D0>	<D1>	...	<D len-1>

### 5.3.4. 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>

### 5.3.5. 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>				
Use Bridge mode (promiscuous mode)	0x03								
Use Interface mode	0x04								
Get current list of CAN Filters	0x09								

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>
Get CAN bus baudrate	0x0B	

PGN special handling configuration (flags = 0x01 – allow TP, 0x02 – set BTID on reception)									
Add PGN to special handling list	0x07	<PGN b0>	<PGN b1>	<PGN b2>	<PGN b3>	<txInt b0>	<txInt b1>	<flags b0>	<flags b1>
Remove PGN from special handling list	0x08	<PGN b0>	<PGN b1>	<PGN b2>	<PGN b3>				
Get PGNs in the special handling list	0x0A								

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	

<b>PIN Codes</b> (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	<b>0x20</b>	<o0>	<o1>	<o2>	<o3>	<o4>	<o5>	<n0>	<n1>	<n2>	<n3>	<n4>	<n5>
Set Config PIN Code	<b>0x21</b>	<o0>	<o1>	<o2>	<o3>	<o4>	<o5>	<n0>	<n1>	<n2>	<n3>	<n4>	<n5>
Set Rem.Acc. PIN Code	<b>0x22</b>	<o0>	<o1>	<o2>	<o3>	<o4>	<o5>	<n0>	<n1>	<n2>	<n3>	<n4>	<n5>

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

### 5.3.6. Poll PGN message

<b>Poll J1939 PGN</b> (Destination Address and Source Address bytes are optional)					
<PGN b0>	<PGN b1>	<PGN b2>	<PGN b3>	<DA>	<SA>



## **6. ECU Setpoints Accessed with the Axiomatic Electronic Assistant**

Currently the CAN2BT device has only CAN bus baud rate and slew rate as Axiomatic Electronic Assistant (later EA) configurable setpoints. The Axiomatic EA can be also 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 bus baud rate can only be configured to either 250k, 500k or 1000k using the EA. The Bluetooth configuration interface has a wider selection of available baud rate settings.

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

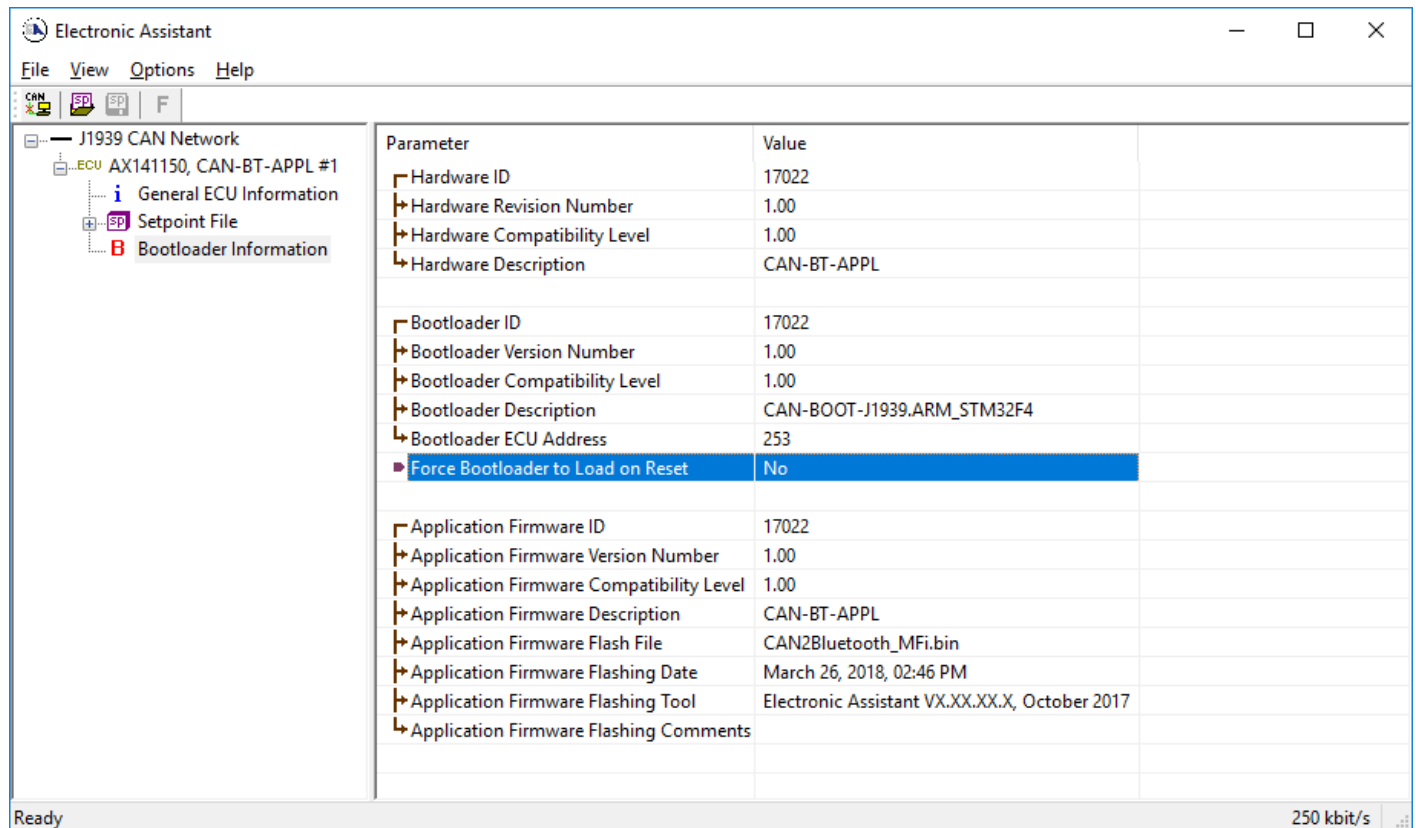
## 7. Reflashing over CAN with the Axiomatic EA Bootloader

The AX141150 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 V5.13.97.0 or higher. **Further, the AX141150 device needs to be in Interface Mode** (CAN receive filtering enabled) in order to be accessible by the Axiomatic EA.*

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

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

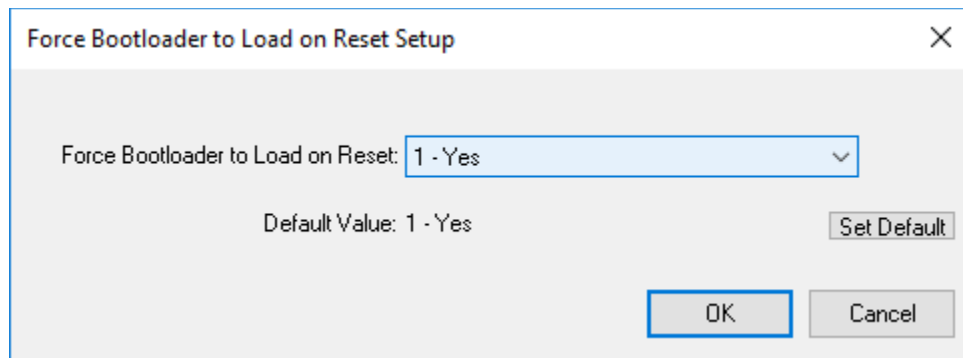


The screenshot shows the Electronic Assistant software interface. The left sidebar displays a tree view of the J1939 CAN Network, with the 'Bootloader Information' section selected. The main window displays a table of parameters and their values.

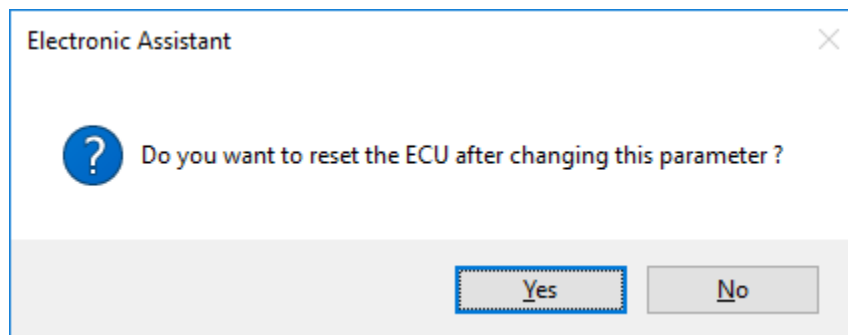
Parameter	Value
Hardware ID	17022
Hardware Revision Number	1.00
Hardware Compatibility Level	1.00
Hardware Description	CAN-BT-APPL
Bootloader ID	17022
Bootloader Version Number	1.00
Bootloader Compatibility Level	1.00
Bootloader Description	CAN-BOOT-J1939.ARM_STM32F4
Bootloader ECU Address	253
Force Bootloader to Load on Reset	No
Application Firmware ID	17022
Application Firmware Version Number	1.00
Application Firmware Compatibility Level	1.00
Application Firmware Description	CAN-BT-APPL
Application Firmware Flash File	CAN2Bluetooth_MFi.bin
Application Firmware Flashing Date	March 26, 2018, 02:46 PM
Application Firmware Flashing Tool	Electronic Assistant VX.XX.XX.X, October 2017
Application Firmware Flashing Comments	

The status bar at the bottom of the window shows 'Ready' on the left and '250 kbit/s' on the right.

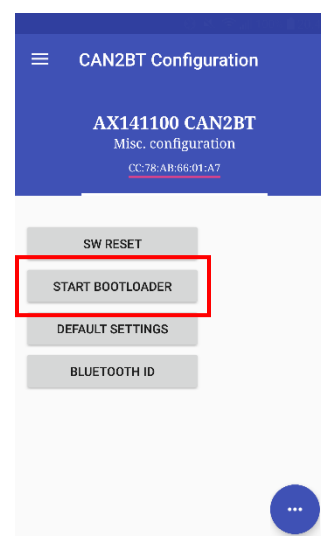
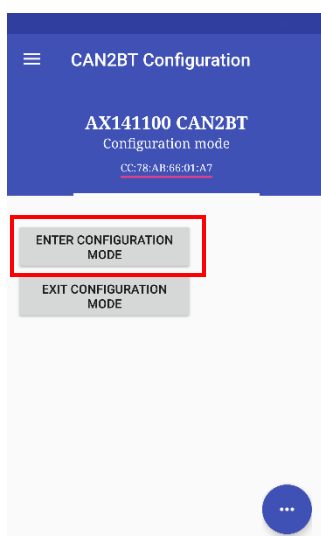
2. To use the bootloader to upgrade the firmware running on the ECU, change the variable “**Force Bootloader To Load on Reset**” to Yes.



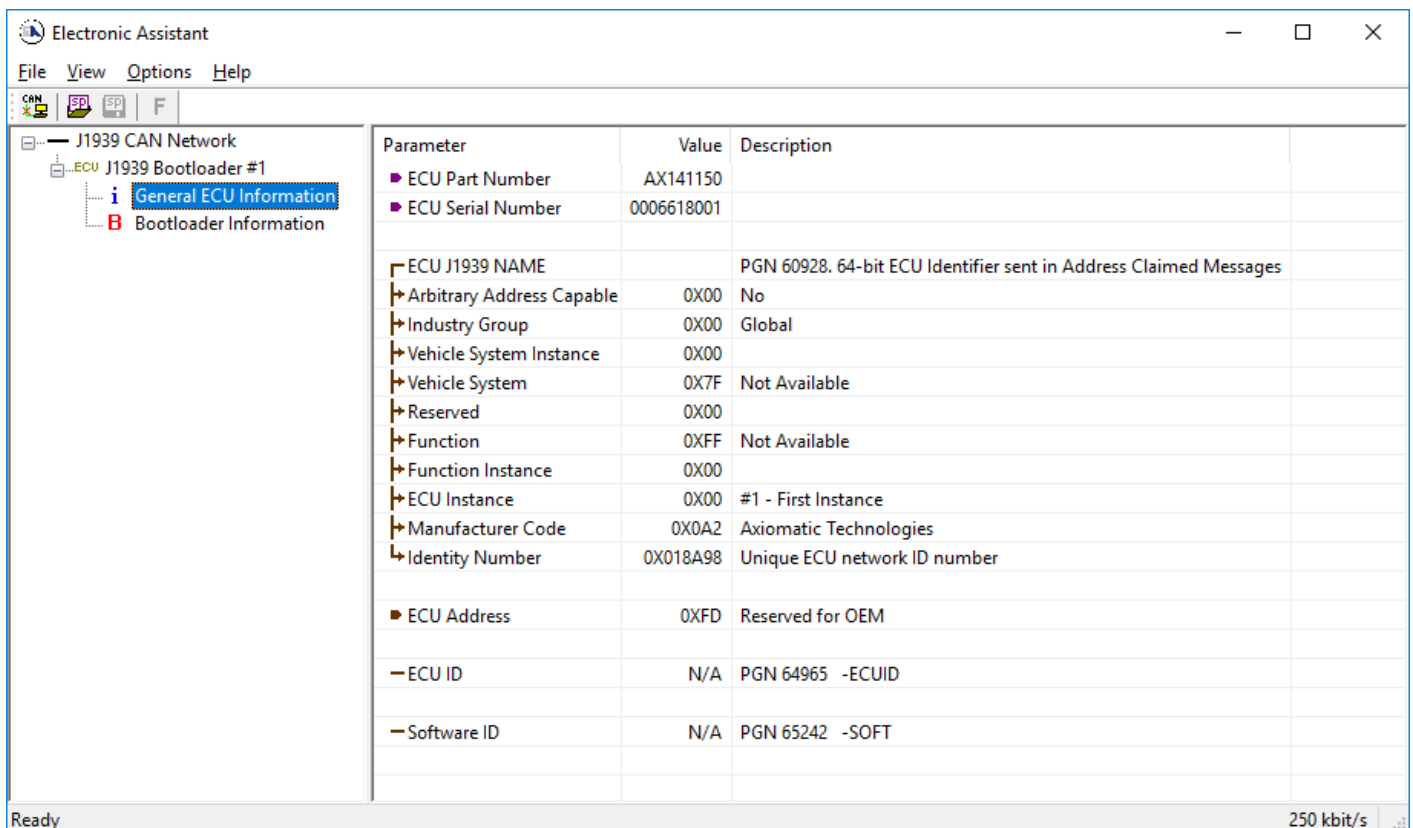
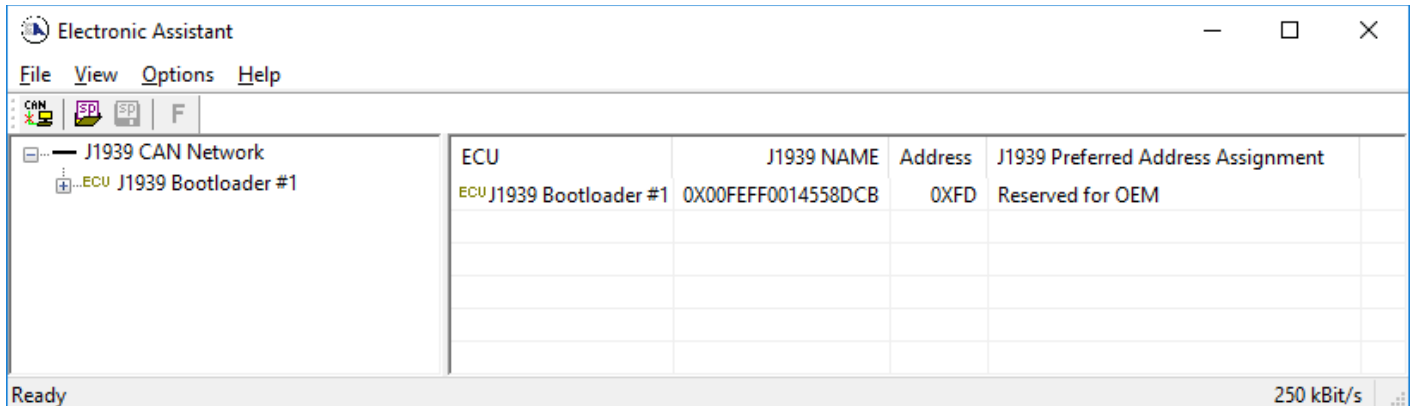
3. When the prompt box asks if you want to reset the ECU, select Yes.



- 3.1 In case the AX141150 device is in Bridge Mode, it cannot be accessed using the Axiomatic EA. In this case, it is possible to start the bootloader from CAN2BT 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).

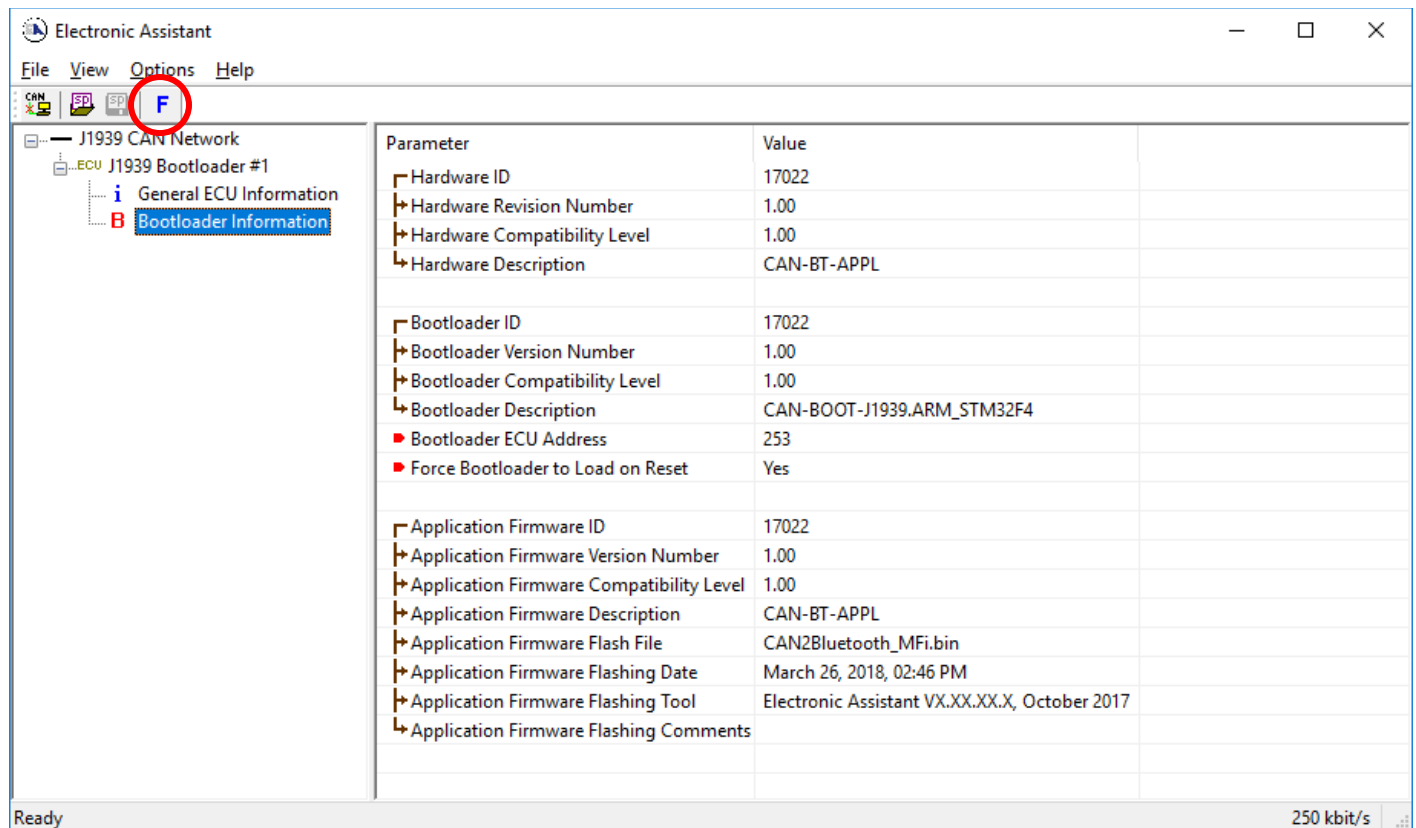


4. Upon reset, the ECU will no longer show up on the J1939 network as an AX141150 but rather as **J1939 Bootloader #1**.



*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 AX141150 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: AF-17022-1.00.bin

Flashing Comments:  
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.

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: AF-17022-1.00.bin

Flashing Comments:  
Press CTRL+ENTER to add a new string

Erase All ECU Flash Memory:

Flashing Status  
Flashing Memory...

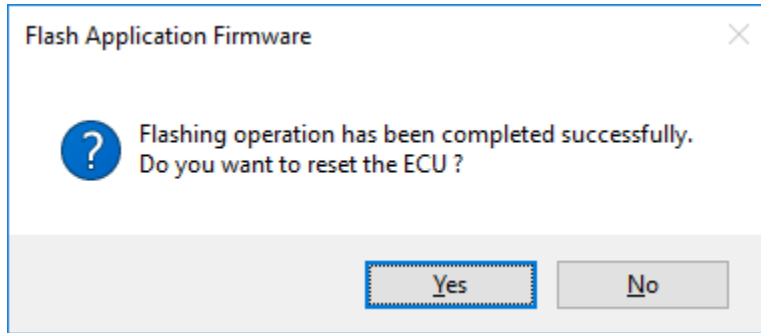
Flash ECU

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 AX141150 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 AX141150 application will run rather than the bootloader function.

Note, if the settings define the AX141150 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 Limitations & Return Materials Process as described on <https://www.axiomatic.com/service/>.

Power Supply Input - Nominal	12Vdc, 24Vdc or 48Vdc nominal (6...80 VDC power supply range) Load dump protection is provided.
Quiescent Current	15 mA @ 24Vdc Typical
Protection	Reverse polarity protection is provided. Overvoltage protection up to 88V is provided.
Microprocessor	STM32F405RGT7 32-bit, 1024 Kbit program flash
CAN	1 CAN port (SAE J1939) CAN bus - In Interface Mode- SAE J1939 or in Bridge Mode – CAN (protocol independent)  CAN bus configuration allows changing the CAN interface baud rate. The list of available baud rate options include 50k, 100k, 125k, 250kbps (default), 500k and 1Mbps.
Bluetooth®	TI CC2564MODA Bluetooth® Host Controller Interface Module Bluetooth LE V4.1 compliant Dual-Mode Bluetooth® V4.0 with classic Bluetooth® and BLE 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.  Serial Port Profile (SPP)
Control Logic	User programmable functionality. Refer to the User Manual.
User Interface	CAN2BT Configuration Application is available from Google Play. <a href="https://play.google.com/store/apps/details?id=com.axiomatic.can2btconfiguration">https://play.google.com/store/apps/details?id=com.axiomatic.can2btconfiguration</a> A configuration application for Apple iOS is also available.
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 Temperature	-30°C to 85°C (-22°F to 185°F)
Protection	IP67
Weight	0.15 lb. (0.06 kg)
Approvals	CE / UKCA marking
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, Ultrasonic welded Nylon 6/6, 30% glass Integral 6-pin connector Refer to the dimensional drawing.
Electrical Connections	6-pin connector (equivalent TE Deutsch P/N: DT04-6P)
Mating Plug Kit	Axiomatic P/N: <b>AX070119</b> (includes 1 plug DT06-6S, 1 wedgelock W6S, and 6 sockets 0462-201-16141)
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 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 inches or 30 cm).

**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](http://axiomatic.com). Any inquiries should be sent to [sales@axiomatic.com](mailto: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](http://www.P65Warnings.ca.gov).

## SERVICE

All products to be returned to Axiomatic require a Return Materials Authorization Number (RMA#) from [rma@axiomatic.com](mailto: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.

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