USER MANUAL UMAX140822
Version 1.0.4

CAN ID NFC CONTROLLER

<u>USER MANUAL</u>

AX140822

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ACRONYMS

ACK	Positive Acknowledgement (from SAE J1939 standard)
BATT +/-	Battery positive (a.k.a. Vps) or Battery Negative (a.k.a. GND)
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
NFC	Near Field Communication
PDU1	A format for messages that are to be sent to a destination address, either specific or global (from SAE J1939 standard)
PDU2	A format used to send information that has been labeled using the Group Extension technique and does not contain a destination address
PropA	Message that uses the Proprietary A PGN for peer-to-peer communication
PropB	Message that uses a Proprietary B PGN for broadcast communication
PGN	Parameter Group Number (from SAE J1939 standard)
SPN	Suspect Parameter Number (from SAE J1939 standard)
Vps	Voltage Power Supply (a.k.a. BATT+)

Note:

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

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1. OVERVIEW OF CONTROLLER

1.1. Description of CAN ID NFC Controller

This User Manual describes the architecture and functionality of the CAN ID NFC Controller. All function blocks on the unit are fully customizable and are be configured with user defined values.

All parameters are configurable using the mobile ***E-Write NFC*** configuration tool available on the Google Play Store and Apple App Store. ***E-Write NFC*** allows the user to configure the module as well as to assign each of the AX140822 controllers a unique alias to easily distinguish between the controllers within a large system.

The controller's NFC technology provides users the ability to configure the controllers without the need the to be powered on. This feature proves especially useful in cases, for example, in which the unit is installed in a system requiring tuning and does not need to be isolated from the system and powered on externally to perform the tuning; instead, the unit can be configured with the system off.

The CAN ID NFC Controller is an extremely versatile designed to transmit of up to five CAN messages, four signal outputs each. Its flexible circuit design gives the user a wide range of configurable options. The sophisticated control algorithms allow the user to program the controller for a wide range of applications without the need for customer software. The various function blocks supported by the CAN-ID-NFC are outlined in the following sections.

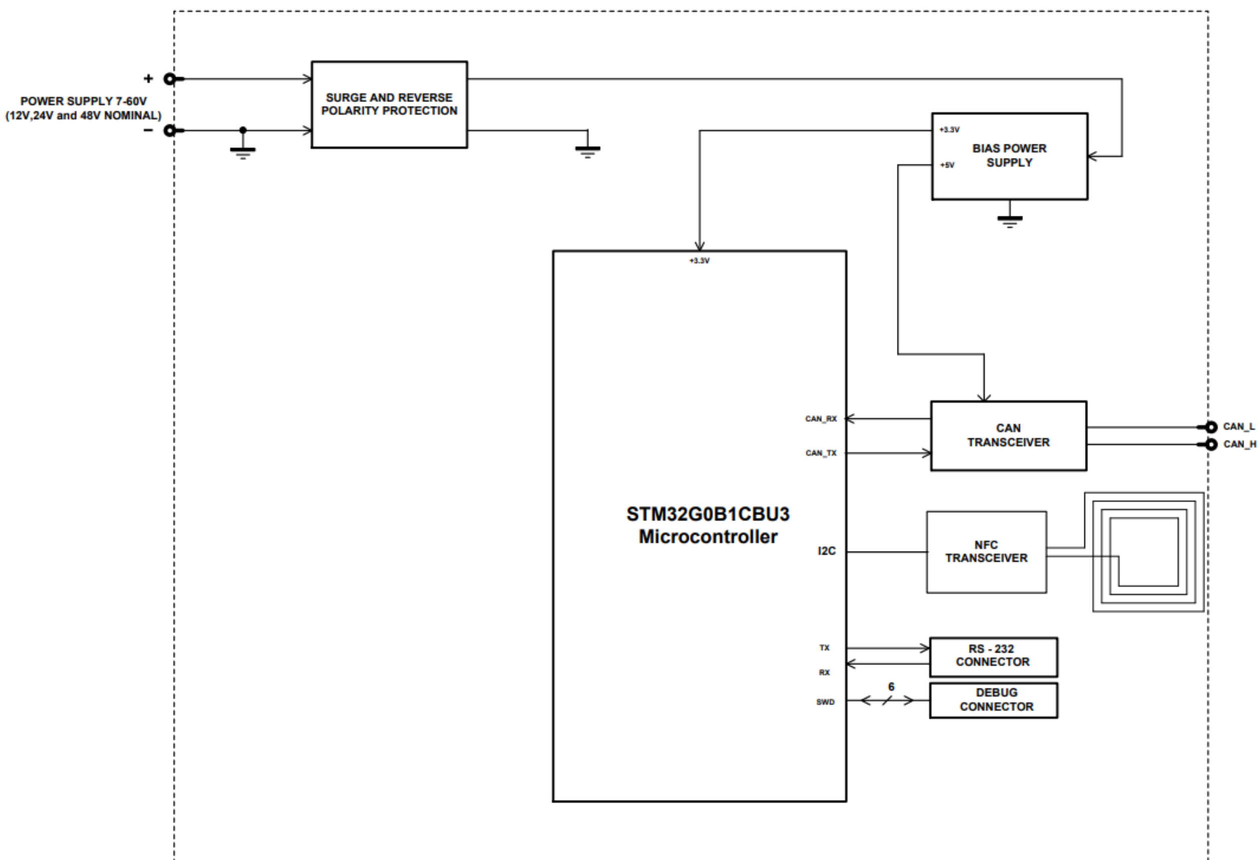


Figure 1 – AX140822 Block Diagram

The ECU Address and NAME of the controller can be customized the controller identity in a CAN network. The address configuration is described in more detail in Section 1.2.

Additionally, the output CAN messages can be configured to send user defined constant values from the twenty available options. The CAN message configuration is described in more detail in Section 1.3.

1.2. Address Claim Configuration

Address configuration is the method by which a particular **Controller Application** (CA) determines the source address it shall use for Address Claim. Each CA shall have one address and an associated NAME to communicate on the J1939 network. The subsections below detail the structure of the **ECU NAME**.

1.2.1. Arbitrary Address Capable

Is a 1-bit field that specifies whether an ECU can use an arbitrary source address to resolve an address claim conflict. If it is set to 1, the ECU can resolve an address conflict with an ECU whose NAME has a greater priority by selecting an arbitrary address in the range 128 to 247.

1.2.2. Industry Group

The Industry Group is a 3-bit field that identifies a particular industry that is associated with the NAME Function. The Industry Group value shall only be one of the Industry Group values assigned and defined by the by SAE J1939.

1.2.3. Vehicle System Instance

Vehicle System Instance is a 4-bit field used to identify a particular occurrence of a particular Vehicle System within a connected network. The Vehicle System Instance is a zero-based number where a value of 0 represents the first instance of that **Vehicle System**.

1.2.4. Vehicle System

Vehicle System is a 7-bit field used to identify the vehicle system or system group associated with the ECU function. The value of each of the Vehicle System is unique within an **Industry Group**. The Vehicle System value used in the ECU NAME shall be one of the values defined by SAE J1939.

1.2.5. Reserved

Reserved for future definition by SAE. The reserved bit is always set to zero.

1.2.6. Function

Function field is an 8-bit value that identifies the function performed by an ECU. A Function is a basic functional component that controls part of a vehicle system. The Function values are divided into Functions that apply across all **Industry Groups** (0 to 127) and Functions that are specific to an Industry Group and **Vehicle System** (128 to 254).

1.2.7. Function Instance

The Function Instance is a 5-bit field that identifies the occurrence of a **Function** on the same Vehicle System on a given network. The Function Instance is a zero-based number where a value of 0 represents the first instance of the Vehicle System.

1.2.8. ECU Instance

The ECU Instance is a 3-bit field that indicates which one of a group of electronic control modules associated with a given Function is being referenced. The ECU Instance is a zero-based number where a value of 0 represents the first instance of an ECU with that Function on a Vehicle System.

1.2.9. Manufacturer Code

The Manufacturer Code is an 11-bit field that indicates the company associated with the ECU. The Manufacturer Code value shall only be one of the Manufacturer Code values assigned by SAE J1939.

"**Manufacturer Code"** field default value is 162 (Axiomatic Technologies Corporation). When Manufacturer Code is set to 162 "**Function"** field value must be 89 (Axiomatic Network Interconnect ECU) and **"Function Instance"** must be 2 (CAN ID NFC Controller). If Manufacturer Code is set to any other value other than 162, Function and Function Instance fields can be set to any of values defined by the J1939 standard.

1.2.10. Identity Number

The Identity Number is a 21-bit field in the name necessary to guarantee uniqueness among identical ECU instances. This field shall be unique and if it varies the unit should be power cycled. By default, the **"Identity Number"** value will be generated based on the unique device identifier.

1.3. Message Data List

The Message Data List Function Block is provided to allow the user to define their own values and select the desired ones for various message signals.

The controller contains two independent Message Data Lists as control sources. Each list consists of ten constant values, holding twenty **Values** of 32-bit in total. The default values are arbitrary and should be configured by the user as appropriate for their application. Each constant also includes a 12-character **Custom Name**. It is helpful to better identify and build the logic around them.

1.4. CAN Message Function Block

The CAN Transmit Message function block is used to send any output from any of the values in Message Data List to the J1939 network. The CAN ID NFC Controller has five CAN Transmit Messages, and each message has four completely user defined signals.

1.4.1. CAN Message Setpoints

Each CAN Transmit Message setpoint group includes setpoints that effect the whole message and are thus mutual for all signals of the message. These setpoints are presented in this section. The setpoints that configure an individual signal are presented in next section.

The “**Transmit PGN**” setpoint sets PGN used with the message. Note that not all the 17-bit combinations are available for assignment. If the PDU Format Field value is less than 240, then the least significant byte of the PGN is set to zero. **User should be familiar with the SAE J1939 standard and select values for PGN/SPN combinations as appropriate from section J1939/71**.

“**Transmission Rate**” setpoint defines the interval used to send the message to the J1939 network. If the “**Repetition Rate**” is set to zero, the message is disabled unless it shares its PGN with another message. In case of a shared PGN repetition rate of the LOWEST numbered message are used to send the message ‘bundle’.

At power up, transmitted message will not be broadcasted until after a 5 second delay. This is done to prevent any power up or initialization conditions from creating problems on the network.

By default, all messages are sent on Proprietary B PGNs as broadcast messages. Thus “**Transmit Message Priority**” is always initialized to 6 (default priority) and the “**Destination Address**” setpoint is not used. Destination Address setpoint is only valid when a PDU1 PGN has been selected, and it can be set a specific address as setup by the user, except to the Global Address (0xFF) or NULL Address (0xFE). “**Endianness**” describes the order of message data bytes.

1.4.2. CAN Signal Setpoints

Each CAN transmit message has four associated signals, which define data inside the Transmit message. “**Data Source**” setpoint together with “**Data Number**” setpoint define the signal source of the message. “**Data Source**” and “**Data Number**” options are listed in Table 1. Setting “**Control Source**” to ‘*Control Not Used’* disables the signal.

“**Data Size**” setpoint determines how many bits signal reserves from the message. “**Bit Index**” determines in which of 64 bits of the Transmit Message the LSB is located. These setpoints are freely configurable, thus **it is the User’s responsibility to ensure that signals do not overlap and mask each other**.

“**Data Resolution**” setpoint determines the scaling done on the signal data before it is sent to the bus. “**Data Offset**” setpoint determines the value that is subtracted from the signal data before it is scaled. Offset and Resolution are interpreted in units of the selected source signal.

1.4.3. Available Data Sources

The CAN Message Function Blocks have selectable data input, which are determined with "**[Name] Source**" and "**[Name] Number**" setpoints. Together, these setpoints uniquely select how the I/O of the various function blocks are linked together. "**[Name] Source**" setpoint determines the type of the source and "**[Name] Number**" selects the actual source if there is more than one of the same types. Available "**[Name] Source**" options and associated "**[Name] Number**" ranges are listed in Table 1. All sources are available for all CAN Transmit messages blocks. All input Sources are freely selectable, not all options would make sense for any input, and it is up to the user to program the controller in a logical and functional manner.

Sources	**Number Range**	**Notes**
0: Control Not Used	N/A	When this is selected, it disables all other setpoints associated with the signal in question.
1: Control Message Data 1	1 to 10	1 to 10 = User Selectable
2: Control Message Data 2	1 to 10	1 to 10 = User Selectable

Table 1 – Available Control Sources and Numbers

2. Installation Instructions

2.1. Dimensions and Pinout

The CAN ID NFC Controller is packaged in a plastic housing from TE Deutsch. The assembly carries an IP67 rating.

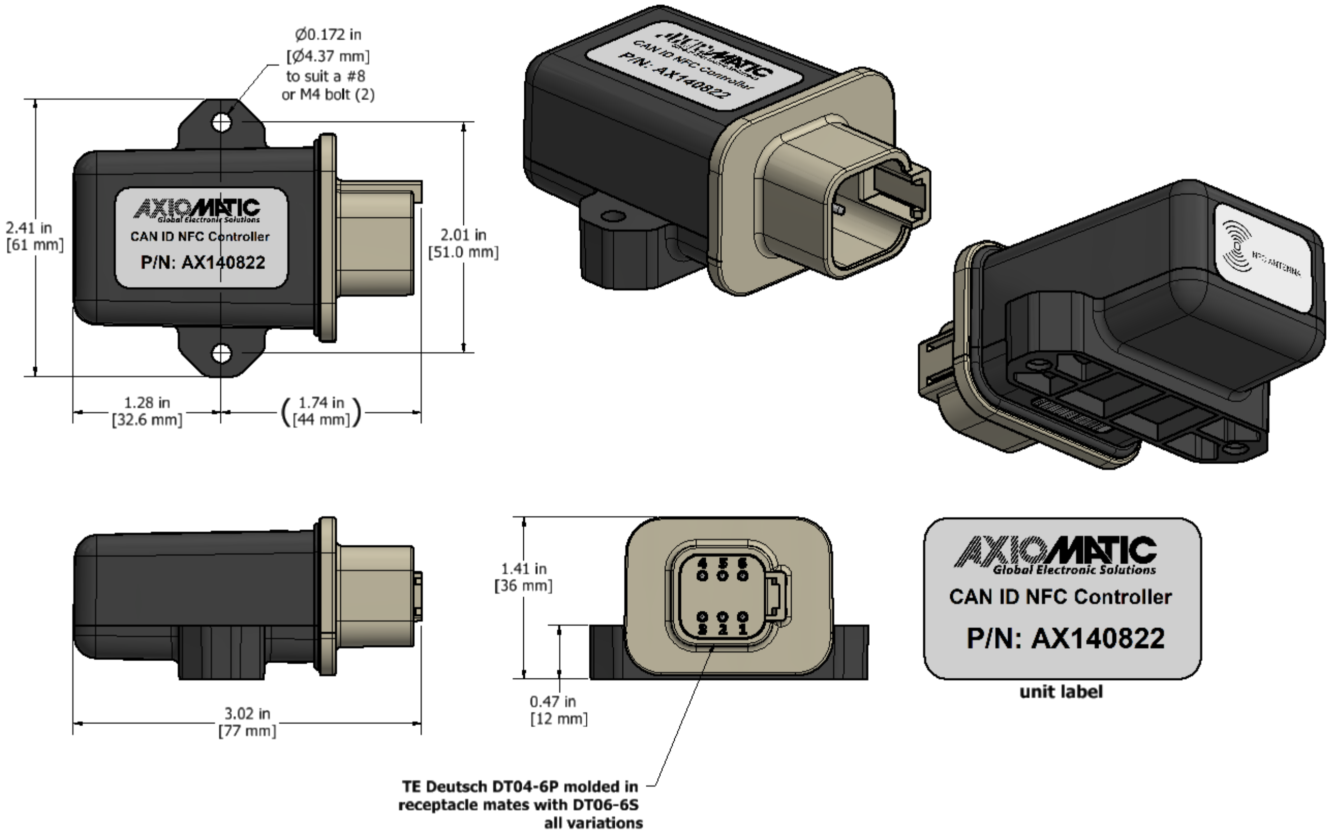


Figure 2 – Housing Dimensions

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

Table 2 – Connector Pinout

2.2. Tips on Configuration with NFC

The location and range of NFC antennas differ from smartphone to smartphone. To accommodate the different ranges and locations, the NFC antenna of the controller is accessible from the bottom side of the housing.

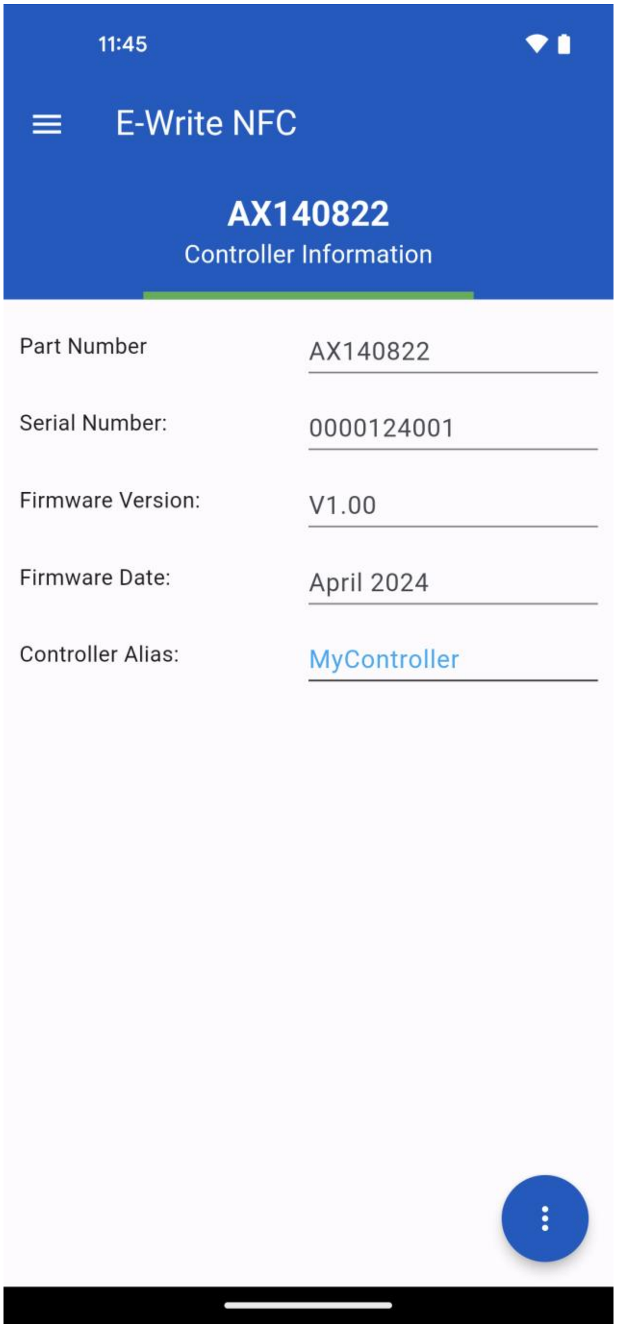
Depending on the NFC antenna location and/or its range of the user's smartphone, it may be more convenient to configure the controller from one side or the other. It is recommended to determine the location of the NFC antenna on the smartphone and/or identify the placement and range that best suits the smartphone.

3. Controller Parameters Accessed with E-Write NFC

Many parameters have been referenced throughout this manual. This section describes and shows each parameter, along with their defaults and ranges. For more information on how each parameter is used by the CAN ID NFC, refer to the relevant section of the User Manual.

3.1. Controller Information

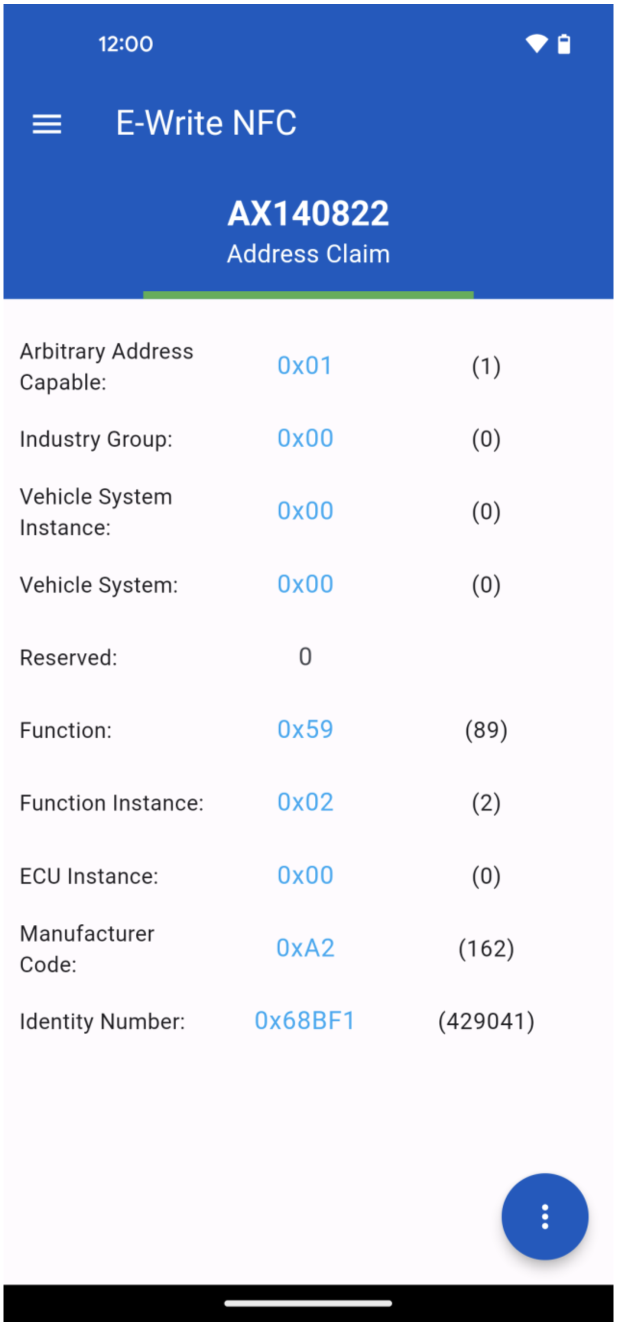
The Controller Information provides information such as current version of firmware and date, serial number, as well as a configurable parameter to better identify the various CAN ID NFC controllers within an application system, Controller Alias.



Screen Capture of Controller Information Parameters

3.2. Address Claim

The Address Claim configuration is defined in Section 1.2. Please refer to that section for detailed information on how these parameters are used.

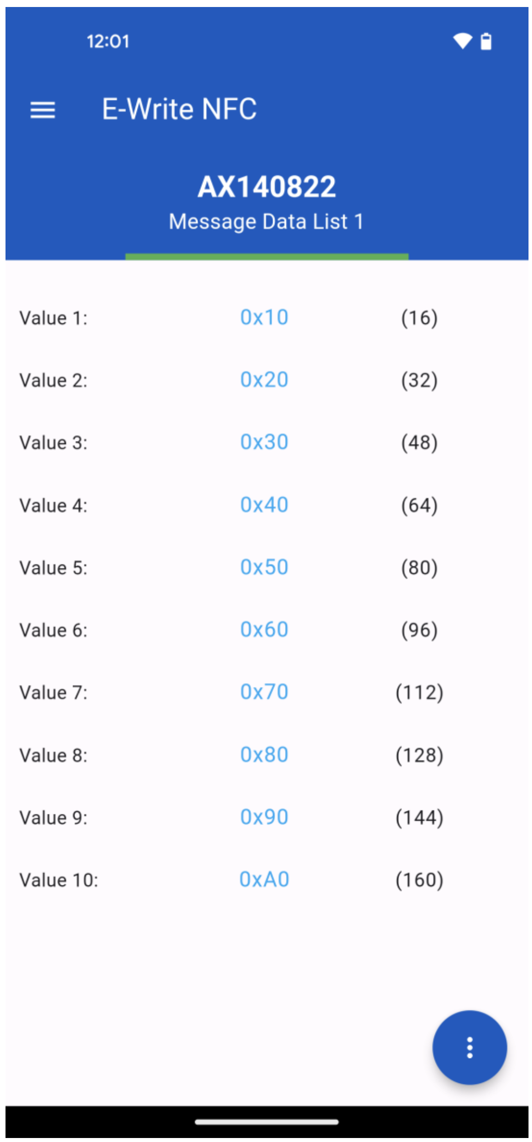


Screen Capture of Default Address Claim Parameters

Name	Range	Default	Notes
Arbitrary Address Capable	0 to 1	1	Refer to Section 1.2.1
Industry Group	0 to 7	0	Refer to Section 1.2.2
Vehicle System Instance	0 to 15	0	Refer to Section 1.2.3
Vehicle System	0 to 127	0	Refer to Section 1.2.4
Reserved	0 to 1	0	Read only value
Function	0 to 255	89	Refer to Section 1.2.6
Function Instance	0 to 31	2	Refer to Section 1.2.7
ECU instance	0 to 7	0	Refer to Section 1.2.8
Manufacturer Code	0 to 2047	162	If set to 162, Function must be 89 and Function Instance must be 2.
Identity Number	0 to 2097151	Random (depends on the hardware)	Refer to Section 1.2.10

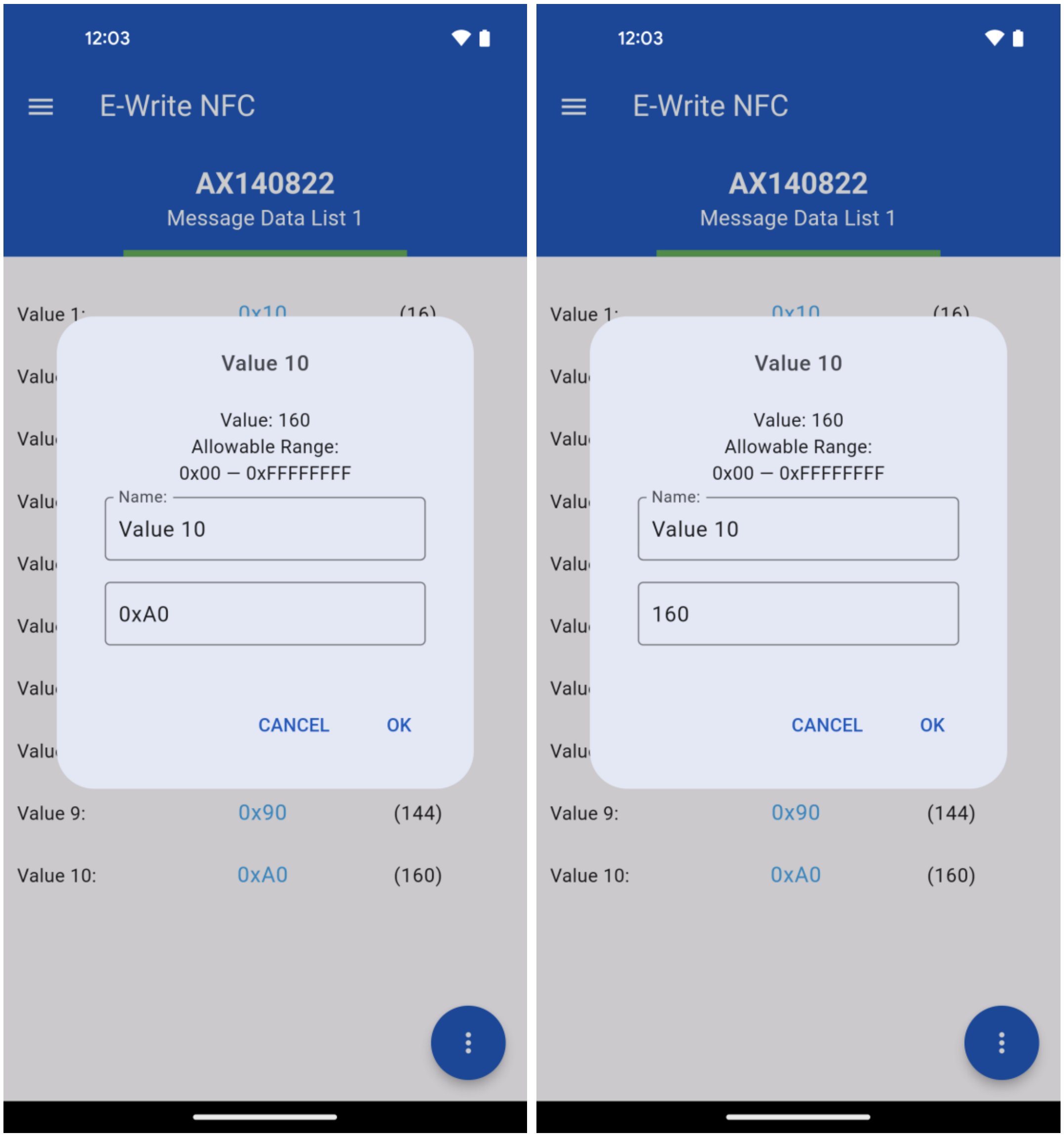
3.3. Message Data List

The Message Data List function block is defined in Section 1.3. Please refer to that section for detailed information on how these parameters are used.



Screen Capture of Default Message Data List 1 Parameters

The data name only alphanumeric values up to a maximum length of 12 characters. The data value can be defined using hexadecimal format, starting with “0x” or simple decimal format.

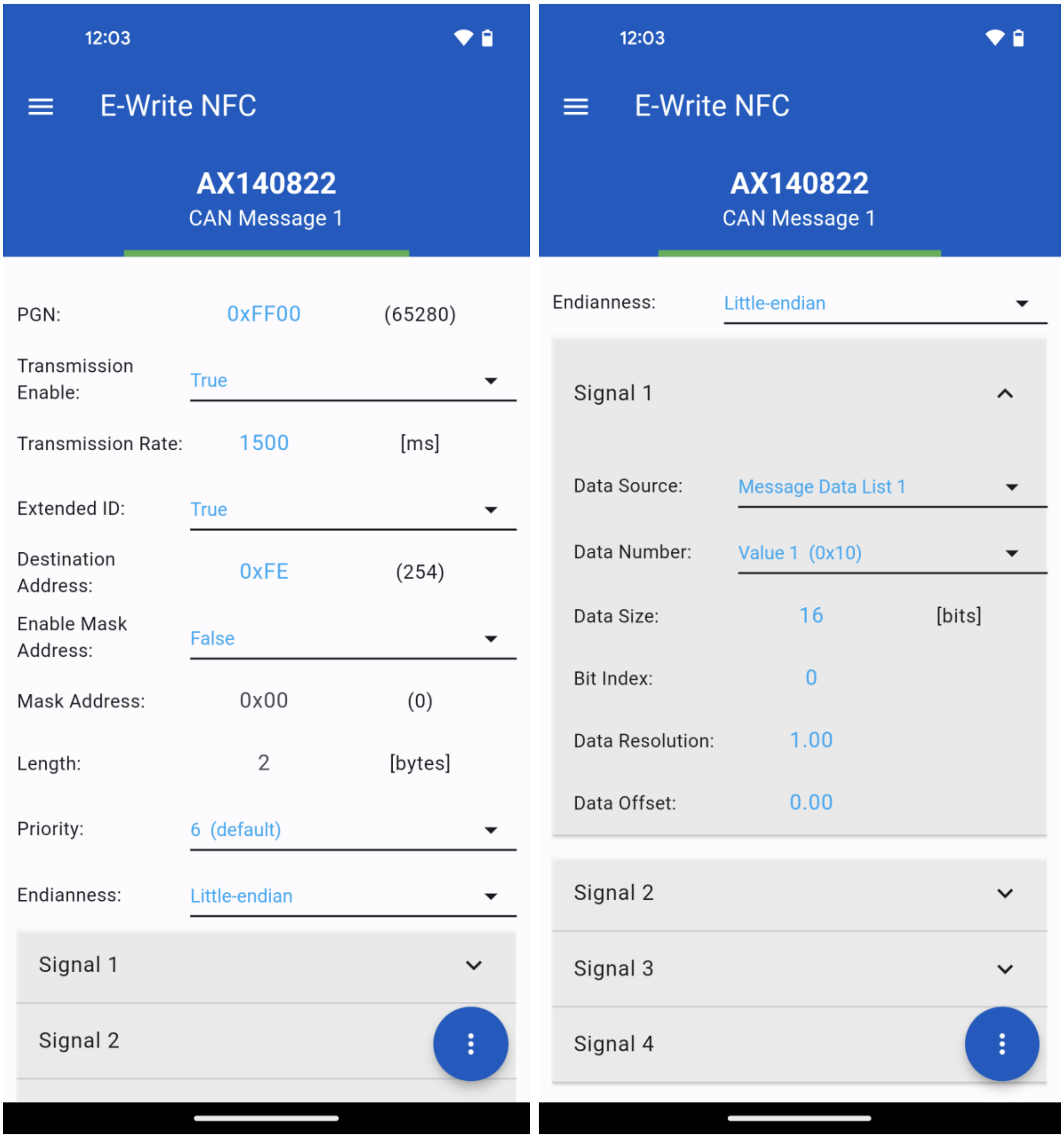


Screen Capture of a Data Input Dialog

Name	Range	Default	Notes
Value 1	0 to 2^{32}	16	Data name can also be user defined
Value 2	0 to 2^{32}	32	Data name can also be user defined
Value 3	0 to 2^{32}	48	Data name can also be user defined
Value 4	0 to 2^{32}	64	Data name can also be user defined
Value 5	0 to 2^{32}	80	Data name can also be user defined
Value 6	0 to 2^{32}	96	Data name can also be user defined
Value 7	0 to 2^{32}	112	Data name can also be user defined
Value 8	0 to 2^{32}	128	Data name can also be user defined
Value 9	0 to 2^{32}	144	Data name can also be user defined
Value 10	0 to 2^{32}	160	Data name can also be user defined

3.4. CAN Message

The CAN Message function block is defined in Section 1.4. Please refer there for detailed information about how all these parameters are used. **"Transmission Enable"** is false and **"Transmit Repetition Rate"** is 0ms by default, thus no message will be sent.



Screen Capture of CAN Message Parameters

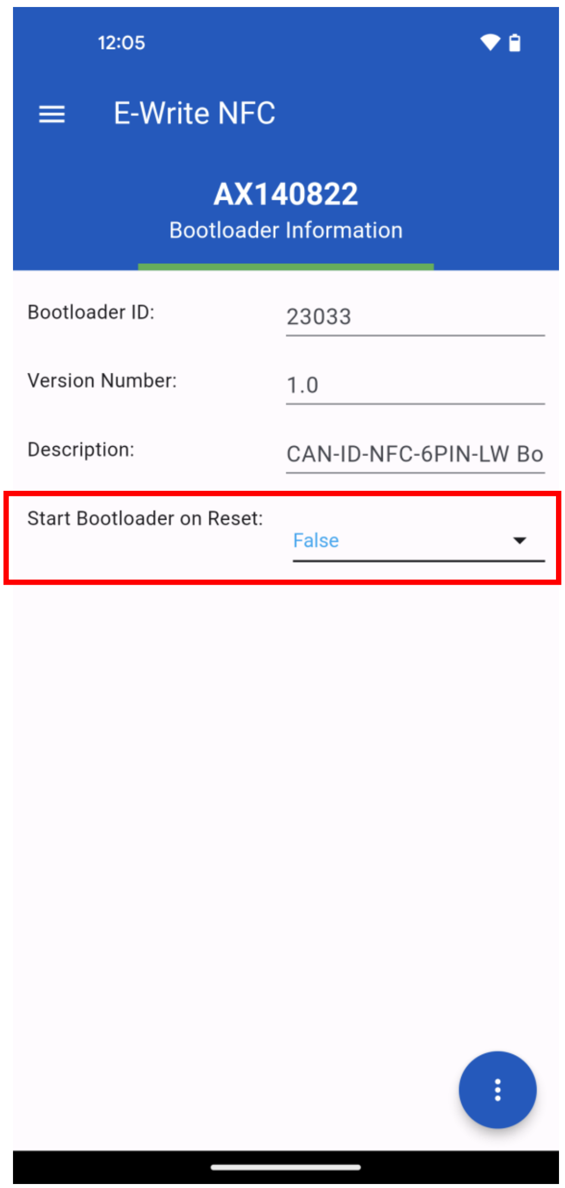
Name	Range	Default	Notes
Transmit PGN	0x00 to 0xffff	Different for each	See Section 1.4.1
Transmit Enable	True or False	False	False disables transmit
Repetition Rate	0 to 65000ms	0ms	0ms disables transmit
Destination Address	0 to 253	253	Not used by default
Enable Mask Address	True or False	False	False disables Mask Address
Message Priority	0 to 7	6	Proprietary B Priority
Message Endianness	Little or Big	Little	See Section 1.4.2
Signal 1 Data Source	Drop List	Control Not Used	See Table 1
Signal 1 Data Number	Drop List	Different for each	See Section 1.4.2
Signal 1 Transmit Data Size	0 to 32 bits	0 bits	
Signal 1 Transmit Bit Index	0 to 64	0	Bit index in whole message
Signal 1 Transmit Data Resolution	-100000 to 100000	1.0	
Signal 1 Transmit Data Offset	-100000 to 100000	0.0	
Signal 2 Data Source	Drop List	Control Not Used	See Table 1
Signal 2 Data Number	Drop List	Different for each	See Section 1.4.2
Signal 2 Transmit Data Size	0 to 32 bits	0 bits	
Signal 2 Transmit Bit Index	0 to 64	0	Bit index in whole message
Signal 2 Transmit Data Resolution	-100000 to 100000	1.0	
Signal 2 Transmit Data Offset	-100000 to 100000	0.0	
Signal 3 Data Source	Drop List	Control Not Used	See Table 1
Signal 3 Data Number	Drop List	Different for each	See Section 1.4.2
Signal 3 Transmit Data Size	0 to 32 bits	0 bits	
Signal 3 Transmit Bit Index	0 to 64	0	Bit index in whole message
Signal 3 Transmit Data Resolution	-100000 to 100000	1.0	
Signal 3 Transmit Data Offset	-100000 to 100000	0.0	
Signal 4 Data Source	Drop List	Control Not Used	See Table 1
Signal 4 Data Number	Drop List	Different for each	See Section 1.4.2
Signal 4 Transmit Data Size	0 to 32 bits	0 bits	
Signal 4 Transmit Bit Index	0 to 64	0	Bit index in whole message
Signal 4 Transmit Data Resolution	-100000 to 100000	1.0	
Signal 4 Transmit Data Offset	-100000 to 100000	0.0	

4. Reflashing Over CAN With the Axiomatic EA and E-Write NFC

The AX140822 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 V5.17.143.0 or higher and E-Write NFC Version 4.1.9 or higher.

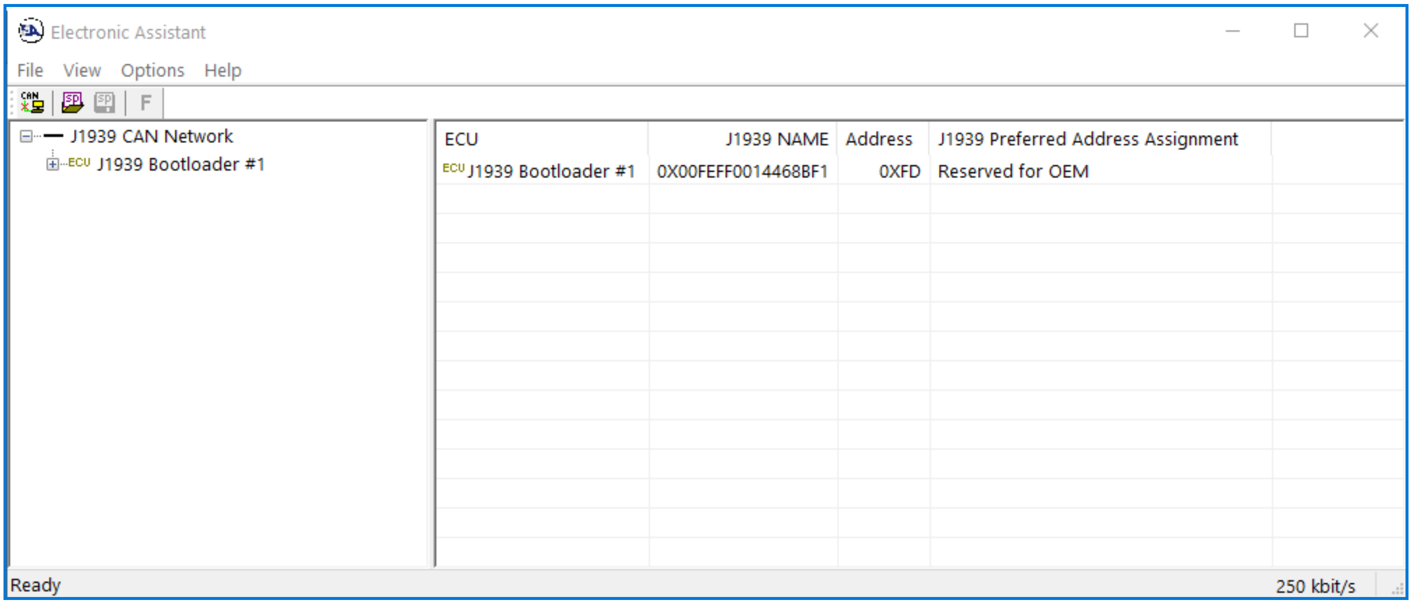
1. Go to **Bootloader Information** section in the E-Write NFC App and it will display the following information.

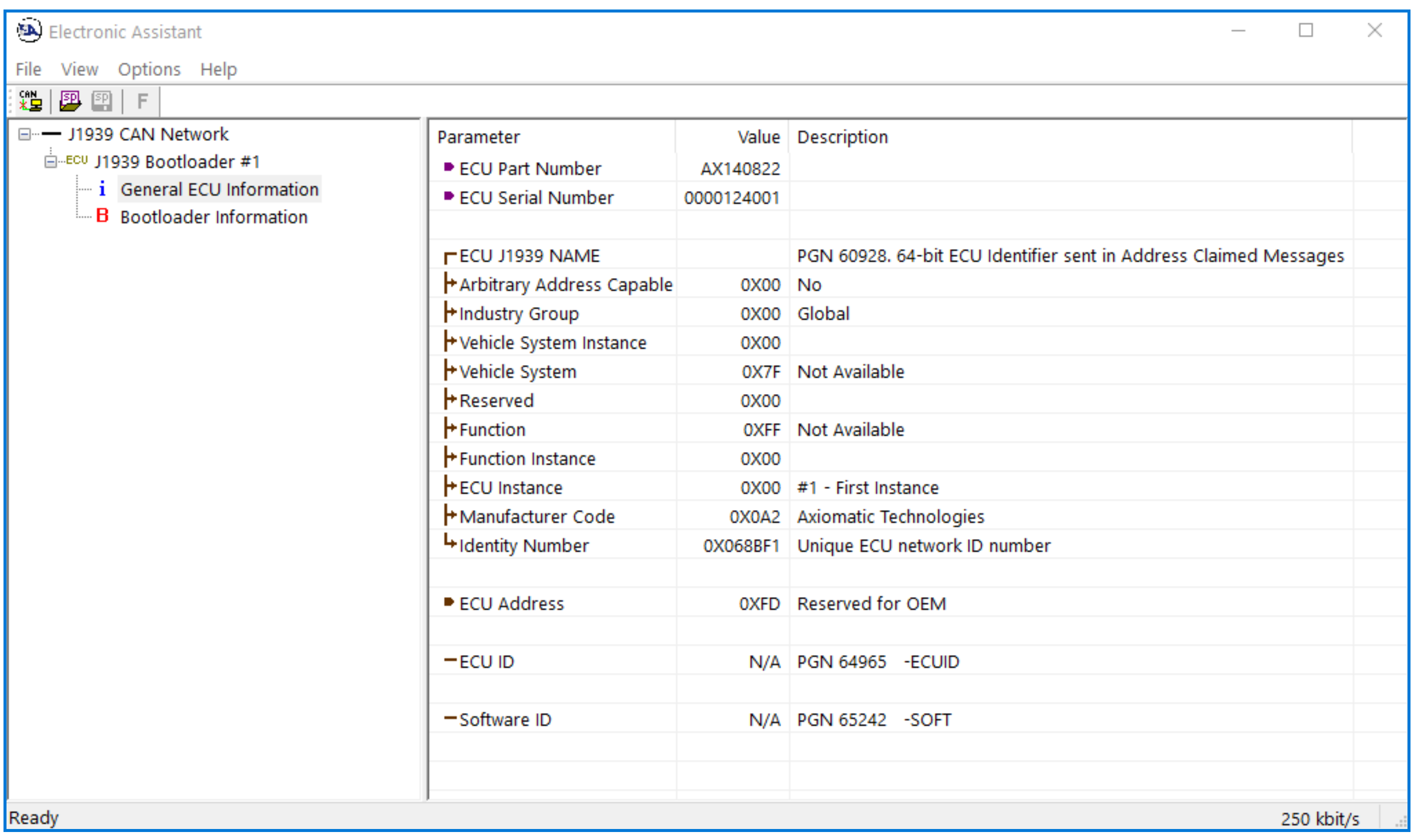


2. To use the bootloader to upgrade the firmware running on the ECU, change the variable **"Start Bootloader on Reset**" to *True.*

3. Write the configuration back to the NFC Controller.

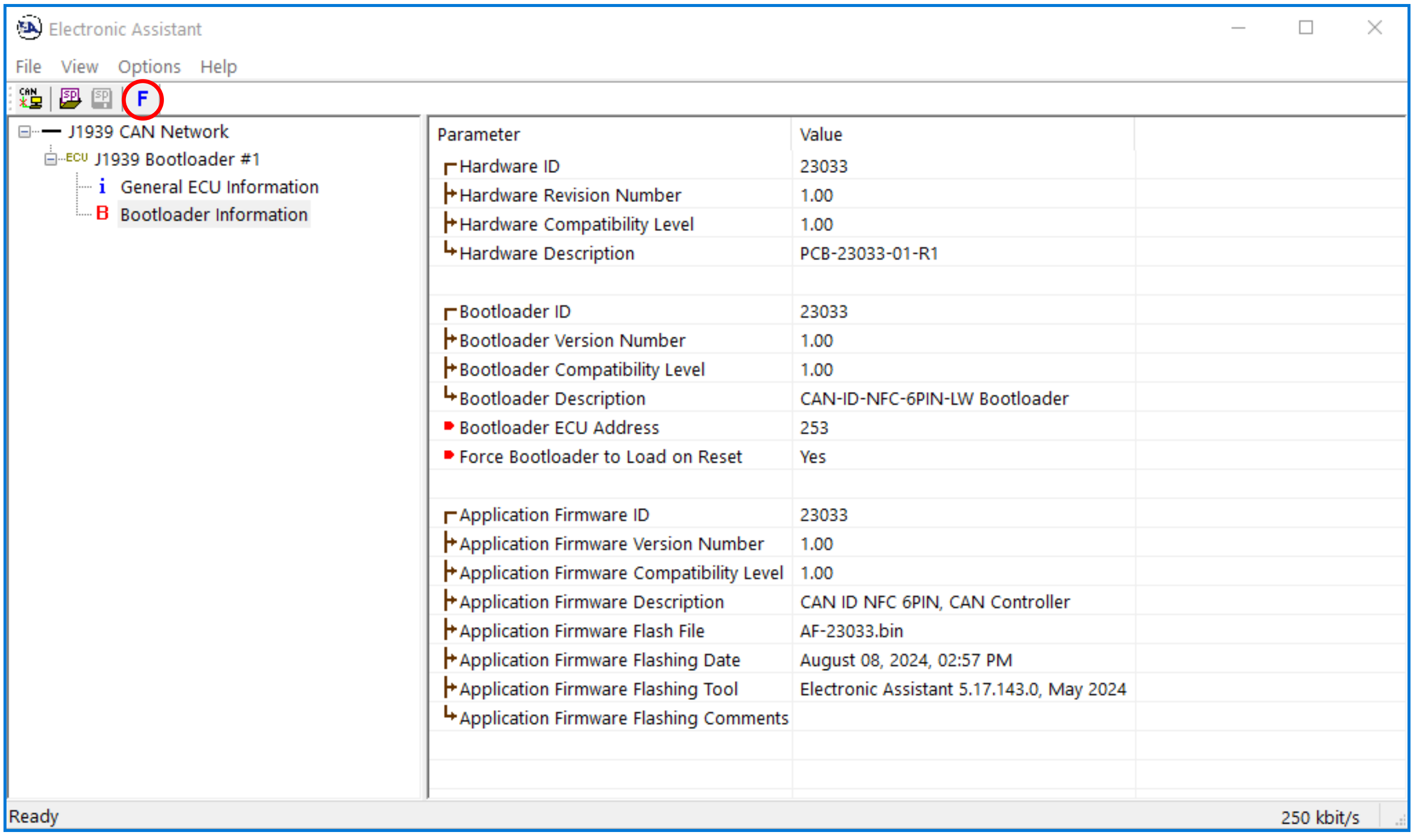
4. If the unit is powered it will reset automatically. Now when the ECU connects to EA it will show up on the J1939 network as **J1939 Bootloader #1**.





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.

5. When the **Bootloader Information** section is selected, the same information is shown as when it was running the AX140822 firmware, but in this case the **F**lashing feature has been enabled.

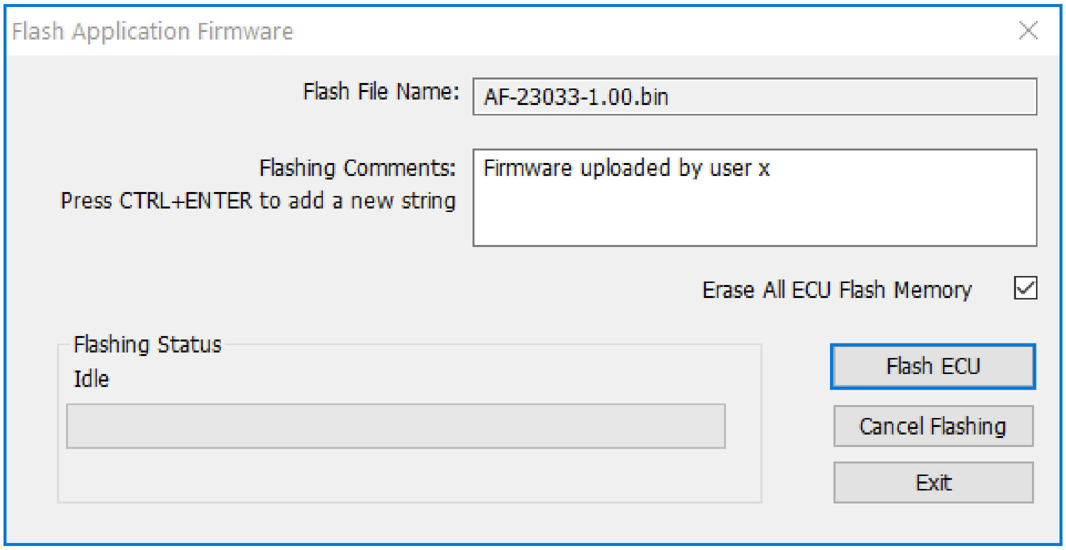


Note: When the ECU is in Bootloader function, and you want to go back to the Application Firmware you need to manually set the "Force Bootloader to Load on Reset" parameter to No. This will start the Application when the ECU is reset, or power cycled.

6. Select the **F**lashing button and navigate to where you had saved the **AF-23033-1.xx.bin** (or equivalent) file sent from Axiomatic. (Note: only binary (.bin) files can be flashed using the Axiomatic EA tool.)

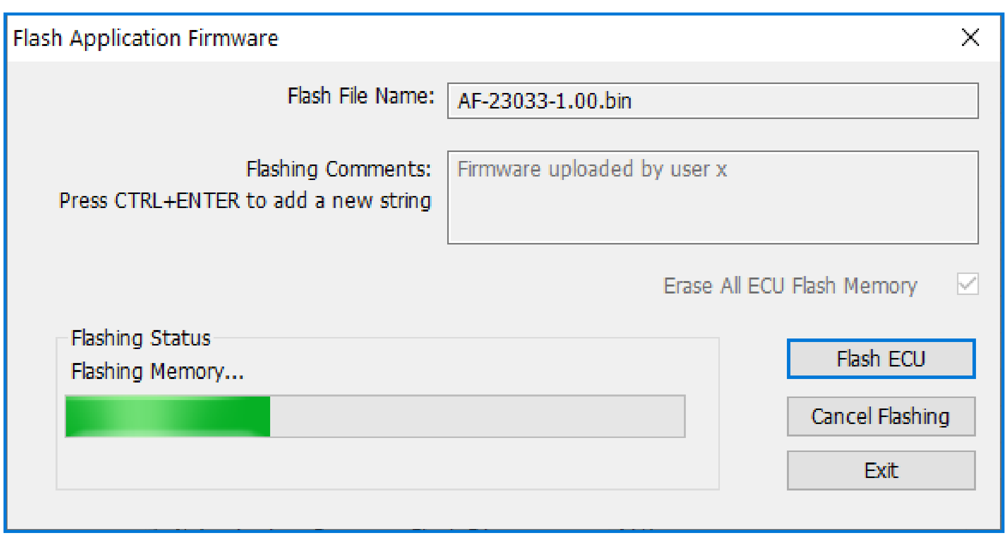
7. Once the Flash Application Firmware window opens, you can enter comments such as “Firmware upgraded by [Name]” if you so desire. This is not required, and you can leave the field blank if you do not want to use it.

Note: You do not have to date-stamp or timestamp the file, as the Axiomatic EA tool automatically does this when you upload the new firmware.

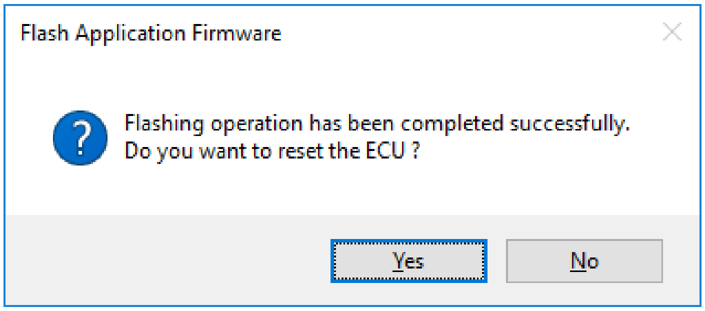


NOTE: It is good practice to tick the “Erase All ECU Flash Memory” box. Please note, that selecting this option will **erase ALL data stored in non-volatile flash**. It will also erase any configuration of the setpoints that might have been done to the ECU and reset all setpoints to their factory defaults. In case the controller contains custom settings, those settings need to be saved to PC before reflashing.

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 AX140822 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 AX140822 application will run rather than the bootloader function.



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.

5. 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/.

Input Power Supply

Input Power Supply	12/ 24/ 48 VDC nominal (7 to 60 VDC range)
Quiescent Current Draw	12 mA @ 12 V, 7.2 mA @ 24 V
Protections	Reverse polarity protection up to -400 V Transient and surge protection up to 202 V Undervoltage protection (Hardware shutdown at 6 V) Overvoltage protection (Hardware shutdown at 63 V)

General Specifications

Microcontroller	STM32G0B1CBU3
Control Logic	Standard logic is provided.
CAN Port	1 CAN (SAE J1939) 250 kbit/s, 500 kbit/s, 667 kbit/s, and 1 Mbit/s (Auto-baud-rate detection)
NFC Communications	Near Field Communication Full-duplex Data rate: 106 kbit/s Complies with ISO1443 (RF protocol), ISO13239, and ISO7816 Protected and secure configuration
User Interface	E-WRITE NFC Application is available for a fee from Google Play for Android devices (https://play.google.com/store/apps/details?id=com.axiomatic.ewritenfc). E-WRITE NFC Application can be downloaded for a fee from Apple's App Store for iOS devices (https://apps.apple.com/us/app/e-write-nfc/id6473560354).
Operating Temperature	-40 °C to 85 °C (-40 °F to 185°F)
Storage Temperature	-50 °C to 125 °C (-58 °F to 257 °F)
Compliance	RoHS
Protection	IP67
Weight	0.043 kg (0.095 lb.)
Enclosure and Dimensions	Plastic Enclosure, Nylon 6-6 with 30% glass fill Laser welded 77 mm x 61.3 mm x 35.8 mm (3.02 in x 2.41 in x 1.41 in) Dimensions are inclusive of the integral connector Refer to dimensional drawing.
Electrical Connections	6-pin equivalent TE Deutsch connector P/N: DT04-6P
Mating Plug Kit	A mating plug kit is available as Axiomatic P/N: **AX070119** (includes 1 Plug DT06-6S, 6 Contacts 0462-201-16141, and 1 Wedgelock W6S)
Mating Cables	Not supplied
Installation	Mounting holes 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 0.17 inches (4.4 mm) thick. If the module is mounted without an enclosure, it should be mounted to reduce the likelihood of moisture entry. 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). The CAN wiring is considered intrinsically safe. The power wires are not considered intrinsically safe and so in hazardous locations, they need to be located in conduit or conduit trays at all times. The module must be mounted in an enclosure in hazardous locations for this purpose. All field wiring should be suitable for the operating temperature range of the module.
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.

6. VERSION HISTORY

Version	Date	Author	Modifications
1.0.0	September 6, 2024	Juan Casanova	Initial Draft
1.0.1	September 10, 2024	M Ejaz	Added product weight Marketing review
1.0.2	October 15, 2024	Juan Casanova	Added supplementary notes
1.0.3	January 9, 2025	Juan Casanova	Added PGN assignment limits Changed Destination Address limits Changed E-Write NFC app recommended version
1.0.4	January 10, 2025	M Ejaz	Updated dimensional drawing Added quiescent current

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

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