USER MANUAL UMAX130410
Version 2.0.1

Precision LVDT Simulator Isolated

CAN (SAE J1939)
Ethernet
USB Type-C (USB 2.0)

USER MANUAL

P/N: AX130410

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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)
DM	Diagnostic Message (from SAE J1939 standard)
DTC	Diagnostic Trouble Code (from SAE J1939 standard)
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-)
I/O	Inputs and Outputs
MAP	Memory Access Protocol
NAK	Negative Acknowledgement (from SAE J1939 standard)
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 is used to send information that has been labeled using the Group Extension technique and does not contain a destination address.
PGN	Parameter Group Number (from SAE J1939 standard)
PropA	Message that uses the Proprietary A PGN for peer-to-peer communication.
PropB	Message that uses a Proprietary B PGN for broadcast communication.
SPN	Suspect Parameter Number (from SAE J1939 standard)
TP	Transport Protocol
Vps	Voltage Power Supply (a.k.a. BATT+)

TABLE OF CONTENTS

REFERENCES

J1939	Recommended Practice for a Serial Control and Communications Vehicle Network, SAE, February 2010
J1939/21	Data Link Layer, SAE, December 2006
J1939/71	Vehicle Application Layer, SAE, March 2011
J1939/73	Application Layer-Diagnostics, SAE, February 2010
J1939/81	Network Management, SAE, March 2017
TDAX130410	Technical Datasheet, Axiomatic Technologies
UMAX07050x	User Manual, 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.

1. OVERVIEW OF CONTROLLER

The LVDT Simulator is used to test LVDT or RVDT sensors. Using CAN commands or a web browser the unit provides two simulation sinusoidal wave outputs with amplitude of 1-5VAC. Both outputs are fully isolated. The unit accepts power supply input from 4 to 32VDC. When the command is sent to increase the output voltage A from 1 to 5VAC, the output voltage amplitude of Output B decreases from 5 to 1VAC. The unit could change the frequency of both outputs by another command from 400Hz to 3kHz.

Numerous configurable variables, called setpoints, have been provided which are accessible using Axiomatic Electronic Assistant. Information about the setpoint defaults and ranges is outlined in Section 4. The EA communicates with the controller over the J1939 CAN bus and uses Memory Access Protocol (MAP) to read/write each setpoint. Once the ECU has been set up as desired, the setpoints can be saved to a file, and flashed into other controllers over the CAN bus using the Axiomatic Electronic Assistant (EA). The configuration also can be done using USB or a web browser and the built-in web server running on the LVDT Simulator (port 80).

The Axiomatic Electronic Assistant, an embedded web server and an auxiliary USB port allow users to update application firmware.

1.1. Hardware Block Diagram

The controller contains 2 output channels, one CAN, Ethernet, USB-port(Type C), transient and surge suppression polarity protection and a protected power supply. An embedded 32-bit microcontroller provides processing power to the controller.

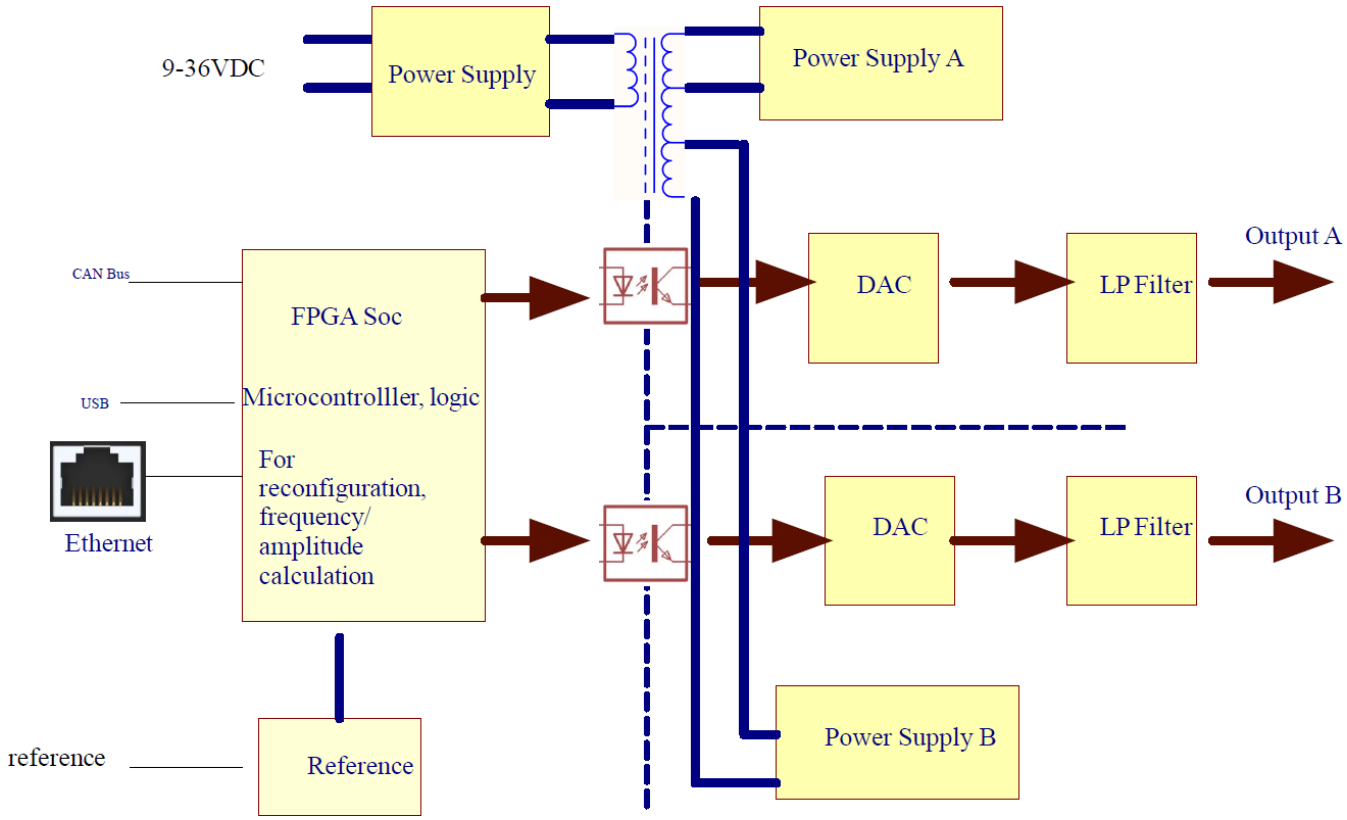


Figure 1. The ECU Flowchart

1.2. LVDT Function Block

The LVDT Function Block consists of only 2 control sources: Voltage Source and Frequency Source. The purpose of them is to set Voltage sinusoidal wave amplitude of the Output A and frequency of Output A and B.

The setting range for Voltage amplitude is 0x00 to 0xFF. The default setting is 0xCC(0d204).

0xFF -> A: 5V, B: 1V

0x00 -> A:1V, B: 5V

The frequency of both outputs is changed in range 400Hz to 3kHz.

When the command is sent to increase the output voltage amplitude A from 1 to 5VAC and the Output voltage amplitude B decreases from 5 to 1VAC. The amplitude of channel A and Channel B

$$A = 51 + \frac{\boldsymbol{control}}{5} * 4$$

$$B = 255 - \frac{\boldsymbol{control}}{5} * 4$$

Regardless of what type of control input is selected, the Output A will always respond in a linear fashion to changes in the input per Equation 1.

$$y = mx + a$$

$$m = \frac{Ymax - Ymin}{Xmax - Xmin}$$

$$a = Ymin - m * Xmin$$

Equation 1. Linear Slope Calculations

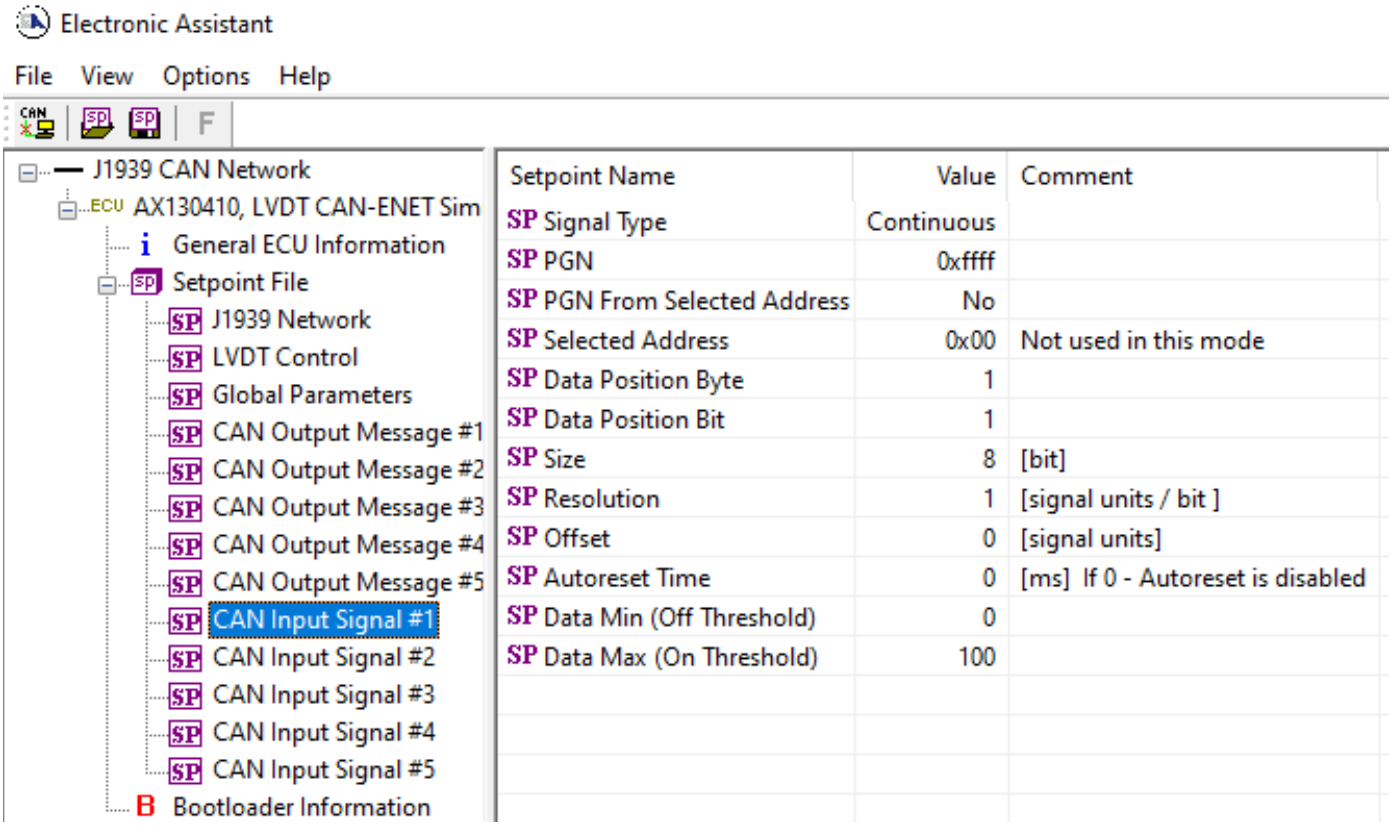
In the case of the Voltage Source, X and Y are defined as

Xmin = Control Input Minimum Ymin = 0 (1V)

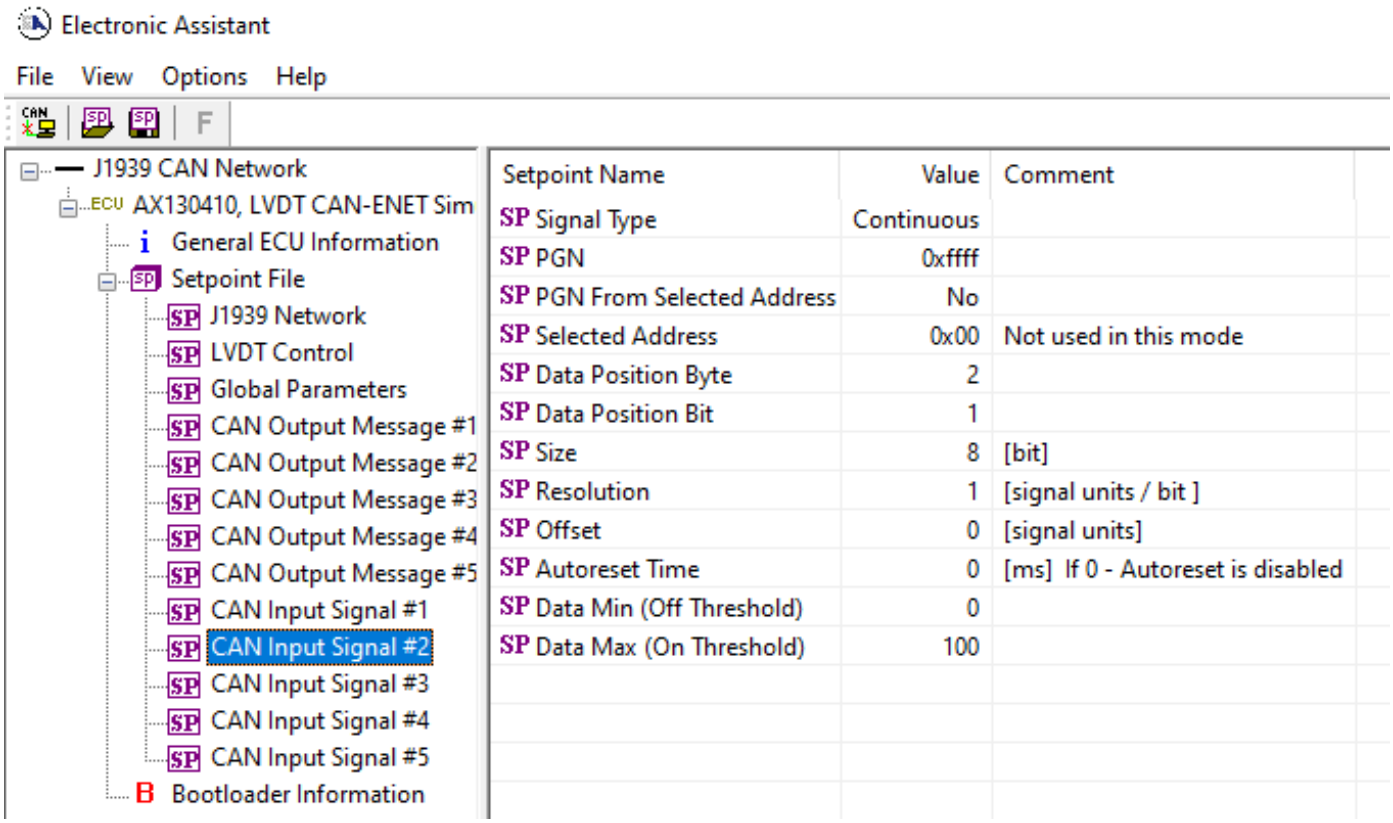
Xmax = Control Input Maximum Ymax = 0xFF (5V)

For example, a CAN command could be used to set the voltage value, in which case it would be converted to a percentage value using ***"Data Minimum"*** and ***"Data Maximum"*** setpoints in the appropriate *CAN Receive X* function block and then applied to the Voltage Amplitude Output A with range [1..5]V.

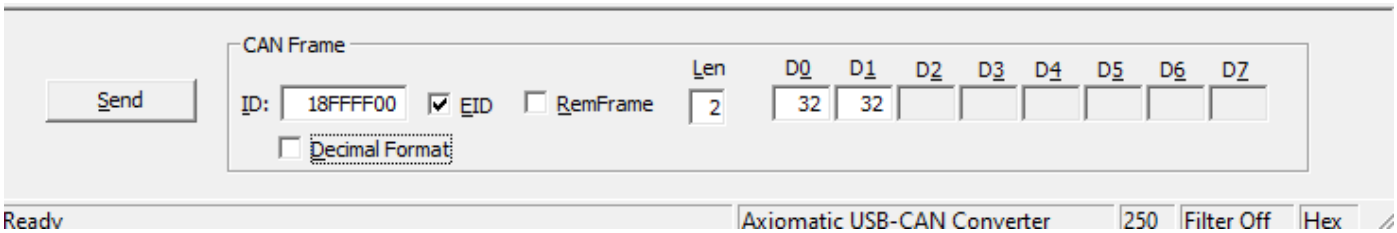
If CAN Input Signal #1 set like this



And CAN Input Signal #2 set like this



CAN command could be like this to set a middle range for the amplitude and frequency



1.3. Constant Data

The Constant Data Block contains 2 fixed (False/True) and configurable constant data setpoints which can be used as a control source for other functions.

Control Constant Data has minimum(-100 or 0) and maximum(0 or 100) assigned to it; thus, user must assign appropriate constant values according to intended use.

1.4. CAN Transmit Message Function Block

The CAN Transmit function block is used to send any output from another function block (i.e. output, CAN receive) to the J1939 network. The AX130410 ECU has five CAN Transmit Messages, and each message has eight completely user defined signals.

1.4.1. CAN Output Message Setpoints

Each CAN Output Message has associated signals, which define data inside the Output message. "**Signal # Source**" setpoint together with "**Signal # Number**" setpoint define the signal source of the message. "**Signal # Source**" and "**Signal # Number**" options are listed in Table 1. Setting "**Signal # Source**" to '*Control Not Used'* disables the signal.

"**Signal # Size**" setpoint determines how many bits signal reserves from the message. "**Signal # Byte Position**" determines in which of 8 bytes of the CAN message LSB of the signal is located. Similarly, "**Signal # Bit Position**" determines in which bits of message the LSB is located. These setpoints are freely configured, thus **it is the user's responsibility to ensure that signals do not overlap and mask each other**.

"**Signal # Resolution**" setpoint determines the scaling done on the signal data before it is sent to the bus. "**Signal # 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.

The "**PGN**" setpoint sets PGN used with the message. **Users should be familiar with the SAE J1939 standard and select values for PGN/SPN combinations as appropriate from section J1939/71**.

"**Autoreset Time**" 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 the case of a shared PGN repetition rate of the LOWEST numbered message are used to send the message 'bundle'.

At power up, transmitted messages 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 (low priority) and the "**Destination Address**" setpoint is not used. This setpoint is only valid when a PDU1 PGN has been selected, and it can be set either to the Global Address (0xFF) for broadcasts or sent to a specific address as set up by the user.

1.5. CAN Receive Function Block

The CAN Receive function block is designed to take any SPN from the J1939 network and use it as an input to another function block (i.e. LVDT Control).

The “**Receive Message Enabled**” is the most important setpoint associated with this function block and it should be selected first. Changing it will result in other setpoints being enabled/disabled as appropriate. By default, ALL receive messages are disabled.

By default, all control messages are expected to be sent to the AX130410 on Proprietary B PGNs. However, should a PDU1 message be selected, the AX130410 can be setup to receive it from any ECU by setting the “**PGN From Specific Address**” to False (0x00). If a specific address is selected instead, then any other ECU data on the PGN will be ignored.

The “**Receive Data Size**”, “**Receive Data Index in Array (LSB)**”, “**Receive Bit Index in Byte (LSB)**”, “**Receive Resolution**” and “**Receive Offset**” can all be used to map any SPN supported by the J1939 standard to the output data of the Received function block.

As mentioned earlier, a CAN receive function clock can be selected as the source of the control input for the output function blocks. When this is case, the “**Received Data Min (Off Threshold)**” and “**Received Data Max (On Threshold)**” setpoints determine the minimum and maximum values of the control signal. As the names imply, they are also used as the On/Off thresholds for digital output types. These values are in whatever units the data is AFTER the resolution and offset is applied to CAN receive signal.

The AX130410 supports up to 5 unique CAN Receive Messages. Defaults setpoint values are listed in Section 4.5.

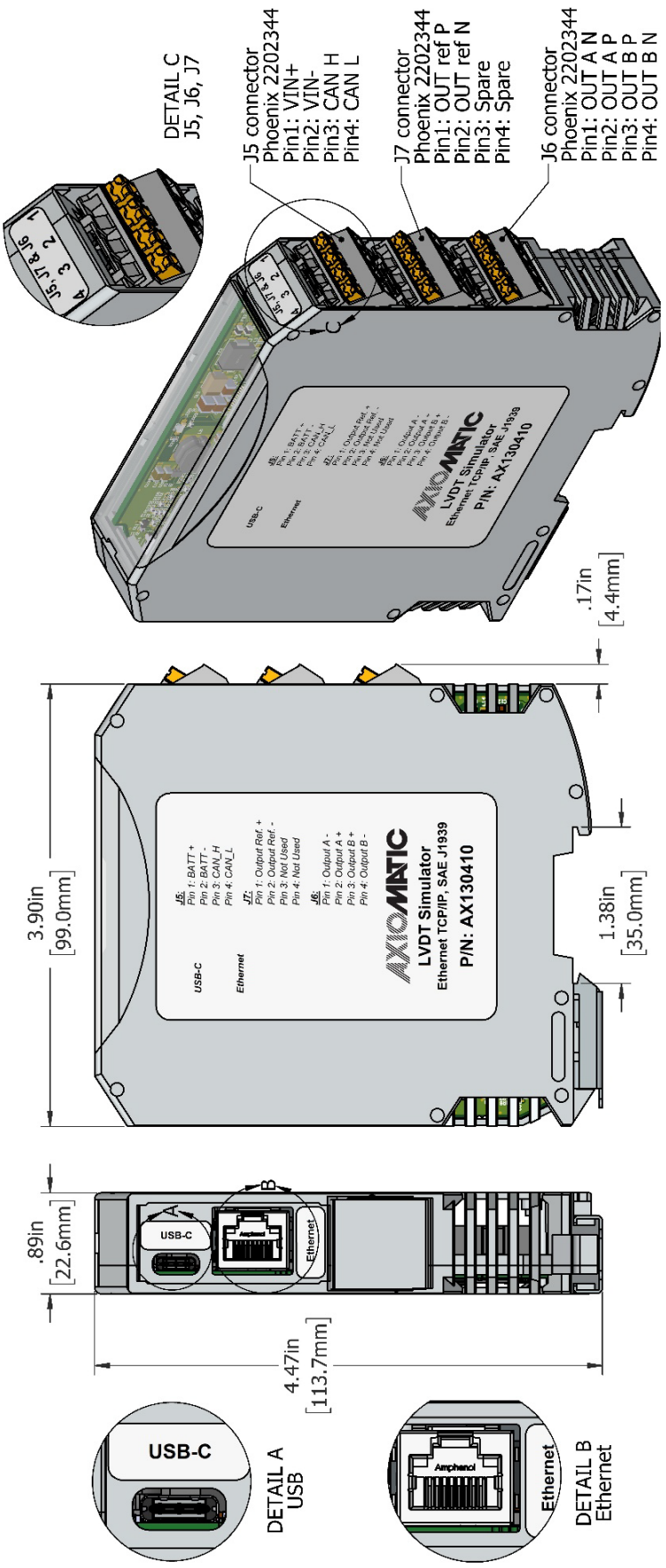
1.6. Available Control Sources

Many of the Function Blocks have selectable input signals, 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, except "CAN message reception timeout", are available for all blocks, including output control blocks and CAN Transmit messages. Though input Sources are freely selectable, not all options would make sense, and it is up to the user to program the controller in a logical and functional manner.

Control Source	Range	Notes
0: Control Not Used	N/A	When this is selected, it disables all other setpoints associated with the signal in question.
1: Output Voltage	1 to 2	Output Voltage [0..255] equivalent [1..5]V
2: Output Frequency	1 to 2	Output frequency in Hz
3: Received CAN Message	1 to 5	
4: Constant Data	1 to 10	[0] - Constant Signal = 0.0 [1] - Constant Signal = 1.0 [2…8] - Data

Table 1. Available Control Sources

2. DIMENSIONAL DRAWING



3. 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)
- Configurable Input Parameters
- Configurable PGN and Data Parameters

3.1. Introduction to Supported Messages

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

From J1939-21 – Data Link Layer

• Request		59904	0x00EA00
• Acknowledgement		59392	0x00E800
• Transport Protocol – Connection Management		60416	0x00EC00
• Transport Protocol – Data Transfer Message		60160	0x00EB00
• Proprietary B	from	65280	0x00FF00
	to	65535	0x00FFFF

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

None of the application layer PGNs are supported as part of the default configurations, but they can be selected as desired for transmit function blocks.

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.

3.2. Name, Address and Software ID

The AX130410 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	124, Axiomatic-defined I/O Controllers
Function Instance	5, Axiomatic AX130410
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.

3.2.1. ECU Address

The default value of this setpoint is 234 (0xEA), which is the preferred starting address for self-configurable ECUs as set by the SAE in J1939 tables B3 to B7. The EA will allow the selection of any address between 0 to 253, and ***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 controller will continue select the next highest address until it finds one that it can claim. See J1939/81 for more details about address claiming.

3.2.2. 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

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

(Version)*

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

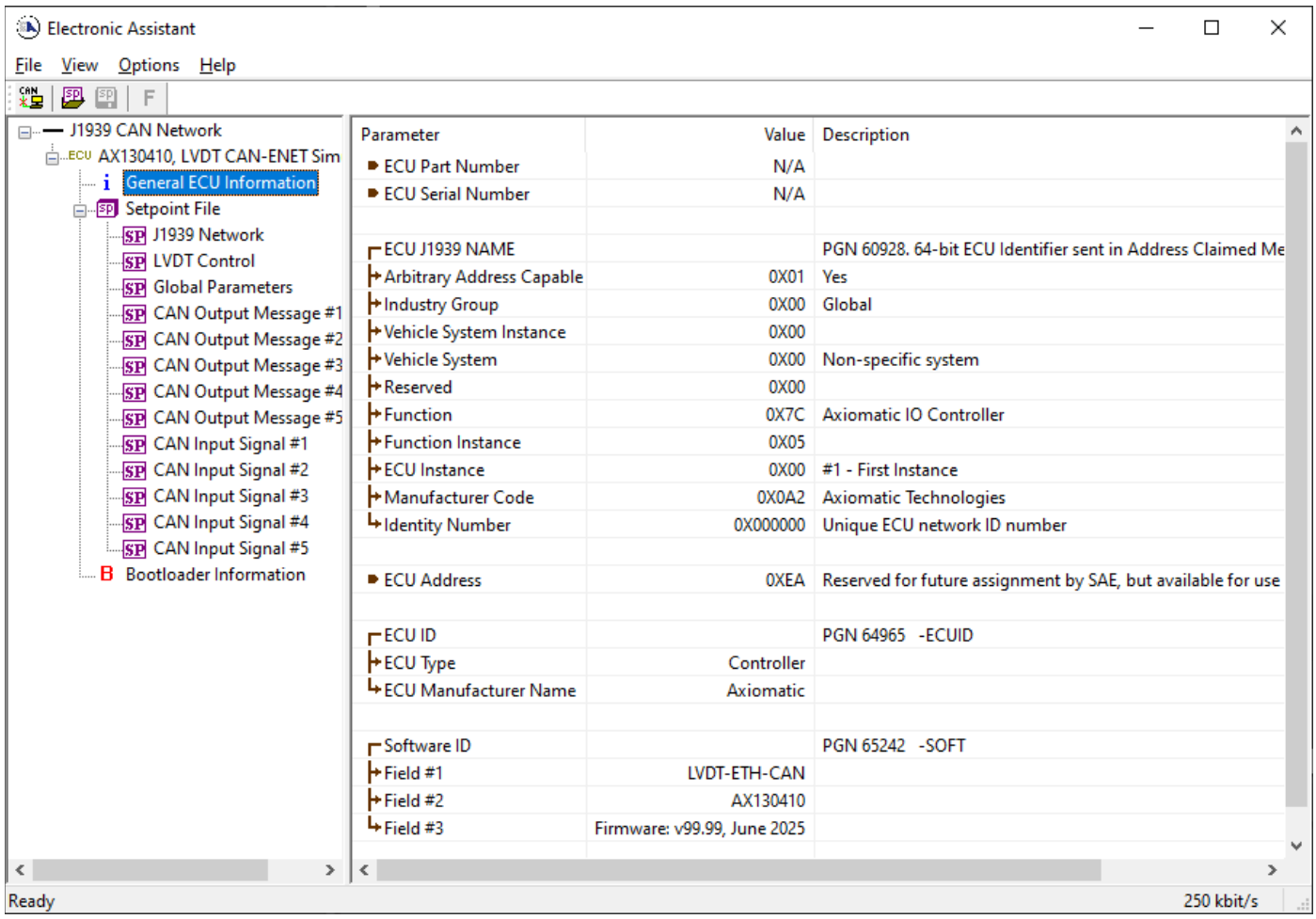


Figure 2. General ECU Information

4. ECU SETPOINTS ACCESSED WITH ELECTRONIC ASSISTANT

Many setpoints have been referenced throughout this manual. This section describes in detail each setpoint, their defaults and ranges. For more information on how each setpoint is used by the ECU, refer to the relevant section of the User Manual.

4.1. J1939 Network Setpoints

The J1939 Network setpoints deal with setpoints such as *ECU Instance Number* and *ECU Address*. Figure 3 and Table 2. Default J1939 Network Setpoints Function blocks in EA below will explain these setpoints and their ranges.

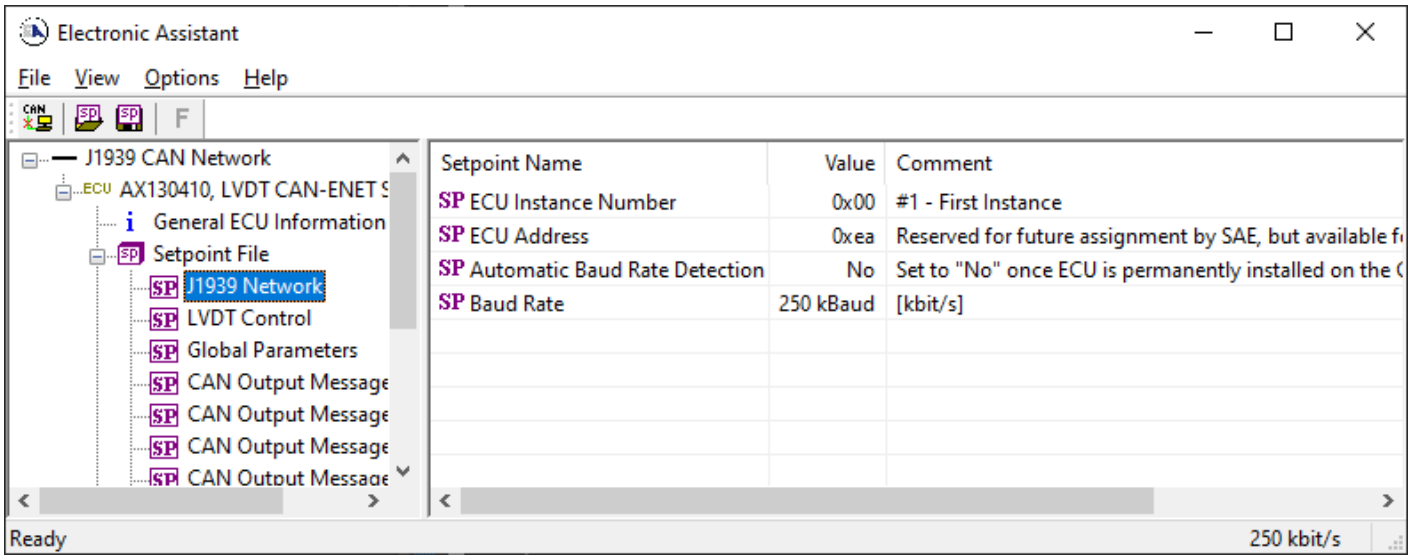


Figure 3. Screen Capture of Default J1939 Network Setpoints

Name	Range	Default	Notes
ECU Address	0..253	**0xEA**	Preferred address for a self-configurable ECU
ECU Instance	0..7	0x00	Per J1939-81
Automatic Baud Rate Detection	0 - No, 1 - Yes	1 - Yes	Set to “No” once ECU is permanently installed on the CAN network.
Baud Rate	{250, 500, 1000}	250	Current baud rate on the CAN network.

Table 2. Default J1939 Network Setpoints Function blocks in EA

4.2. LVDT Control Setpoints

The LVDT Function Block is defined in Section 1.1. Please refer to detailed information about how all these setpoints are used.

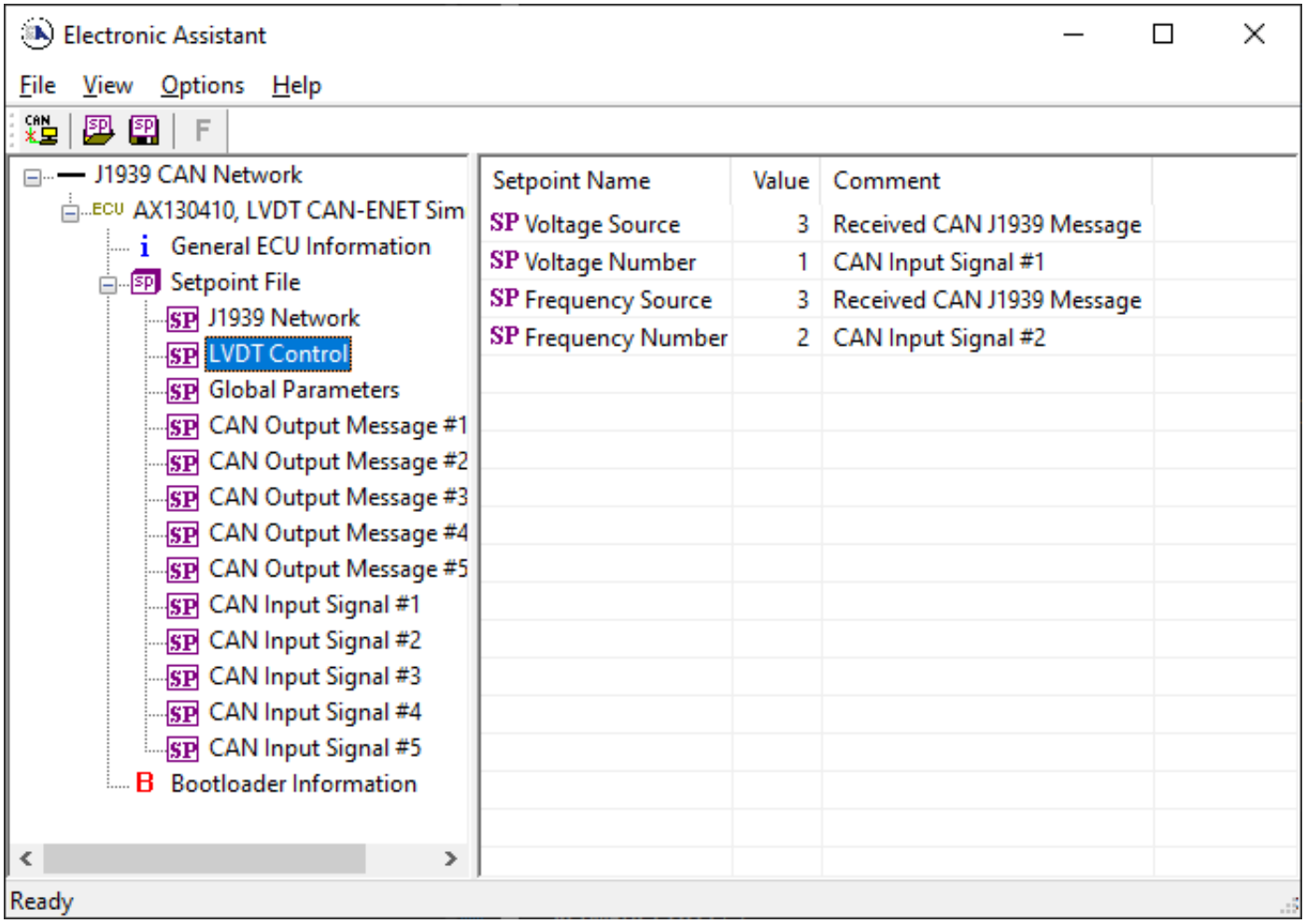


Figure 4. Screen Capture of LVDT Setpoints

Name	Range	Default	Notes
Voltage Source	Drop List	*Control Not Used*	See Table 1
Voltage Number	Drop List	0	See Table 1
Frequency Source	Drop List	*Control Not Used*	See Table 1
Frequency Number	Drop List	0	See Table 1

Table 3. LVDT Control Setpoints

4.3. Constant Data List Setpoints

The Constant Data List Function Block is provided to allow the user to select values as desired for various logic block functions.

The first two constants are fixed values of 0 (False) and 1 (True) for use in binary logic. The remaining 13 constants are fully user programmable to any value between +/- 100. The default values (shown in Figure 5) are arbitrary and should be configured by the user as appropriate for their application.

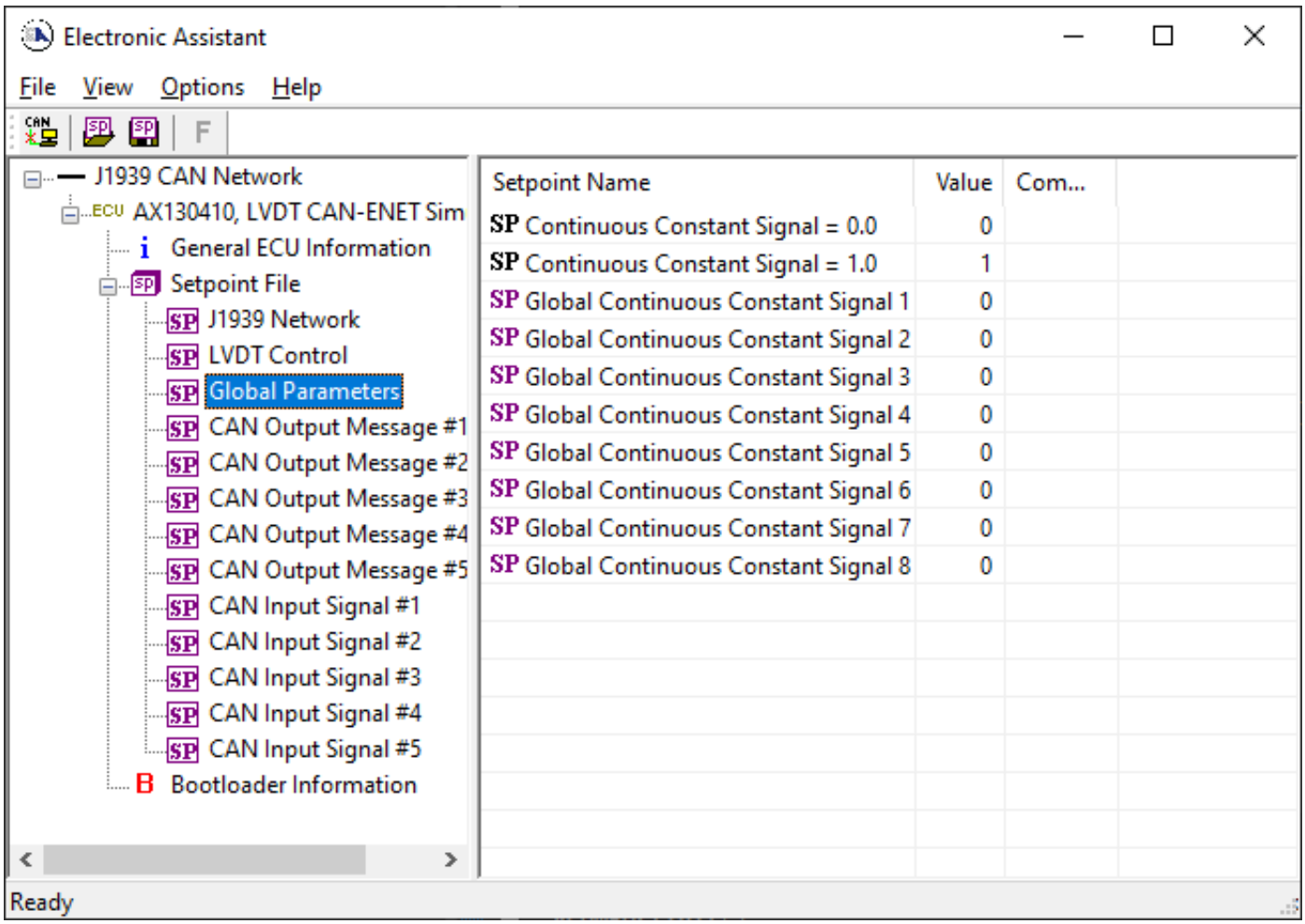


Figure 5. Screen Capture of Constant Data List Setpoints

4.4. CAN Output Message Setpoints

CAN Output Message Function Block is presented in section 0. Please refer there for detailed information on how these setpoints are used. “**Transmission Rate**” is 0ms by default, thus no message will be sent.

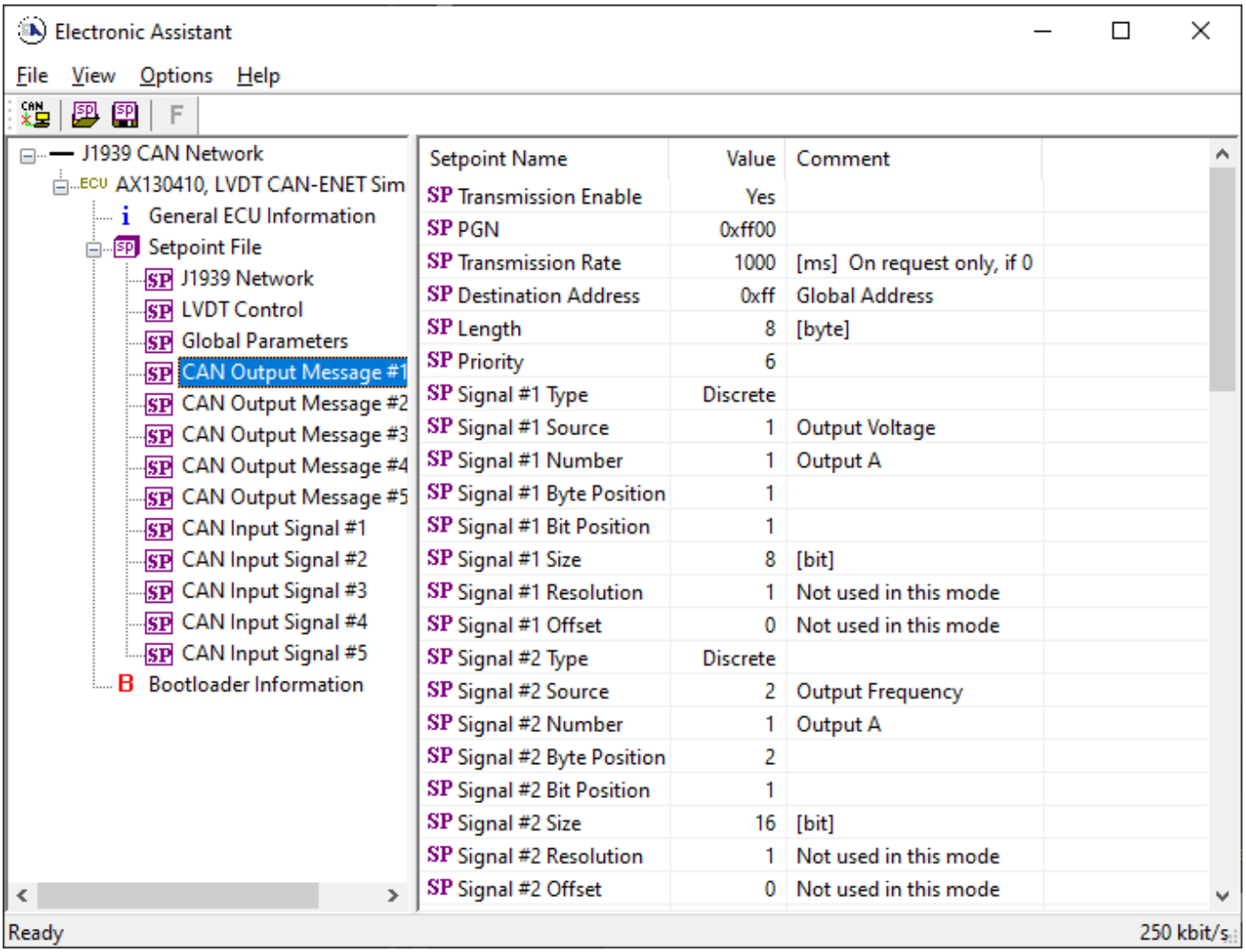


Figure 6. Screen Capture of CAN Output Message Setpoints

Name	Range	Default	Notes
Transmission Enabled	Drop List	0, False	
PGN	0xff00 … 0xffff	Different for each	See Section 1.3.1
Transmission Rate	0 … 65000 ms	0ms	0ms disables transmit
Destination Address	0...255	255	Not used by default
Length	0...8	8	
Priority	0...7	6	Proprietary B Priority
Signal X Type	Drop List	Undefined	
Signal X Source	Drop List	Different for each	See Table 1
Signal X Number	Drop List	Different for each	See Table 1
Signal X Byte Position	1-8	1	
Signal X Bit Position	1-64	1	
Signal X Size	1-64	8bit	
Signal X Resolution	-100000.0 to 100000	1/bits	
Signal X Offset	-10000 to 10000	0.0	

Table 4. CAN Output Message Setpoints

4.5. CAN Input Signal Setpoints

The CAN Input Signal Block is defined in Section 0. Please refer there for detailed information about how these setpoints are used. “**Autoreset Time**” is set to 0ms by default. To enable CAN Input message set “**Signal Type**” to Continuous/Discrete.

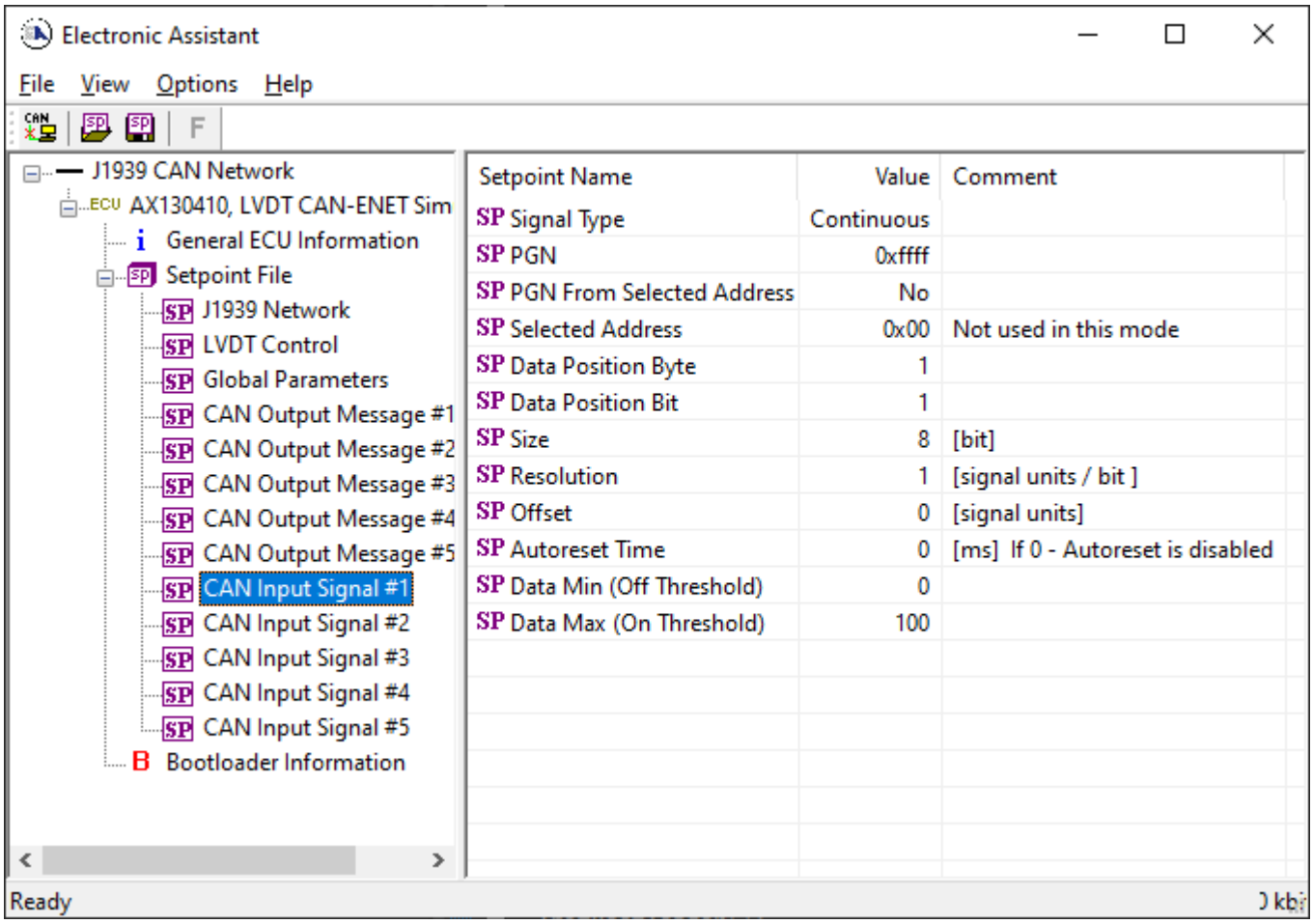


Figure 7. Screen Capture of CAN Receive Message Setpoints

Name	Range	Default	Notes
Signal Type	Drop List	Undefined	
PGN	0 to 65536	Different for each	
PGN From Selected Address	Drop List	No	
Selected Address	0 to 255	254 (0xFE, Null Addr)	
Data Position Byte	1-8	1	
Data Position Bit	1-64	1	
Size	1-64	8bits	
Resolution	-100000.0 to 100000	0.001	
Offset	-10000 to 10000	0.0	
Autoreset Time	0 to 60 000 ms	0ms	
Data Min (Off Threshold)	-1000000 to Max	0.0	
Data Max (On Threshold)	-100000 to 100000	100	

Table 5. CAN Receive Setpoints

4.6. Ethernet Parameter Setpoints

The Ethernet parameters can be configured using EA.

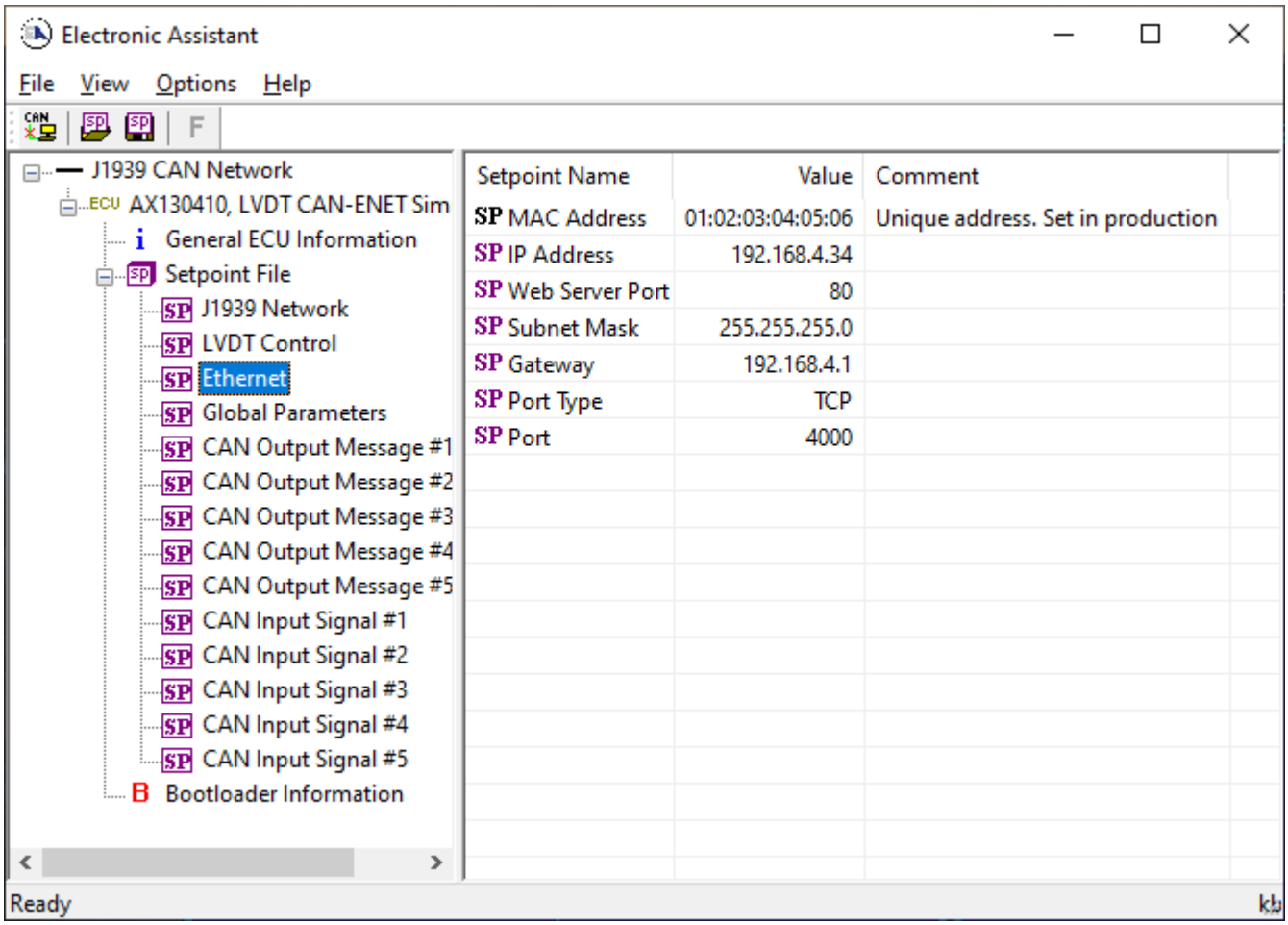


Figure 8 – Screen Capture of Ethernet Parameter Setpoints

5. REFLASHING OVER CAN WITH EA BOOTLOADER

The controller 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 V4.5.53.0 or higher.

To flash the new firmware, the user should activate the embedded bootloader. To do so, start the EA and, on the *Bootloader Information* group screen, click on the *Force Bootloader to Load on Reset* parameter. The following dialog will appear, see Figure 9.

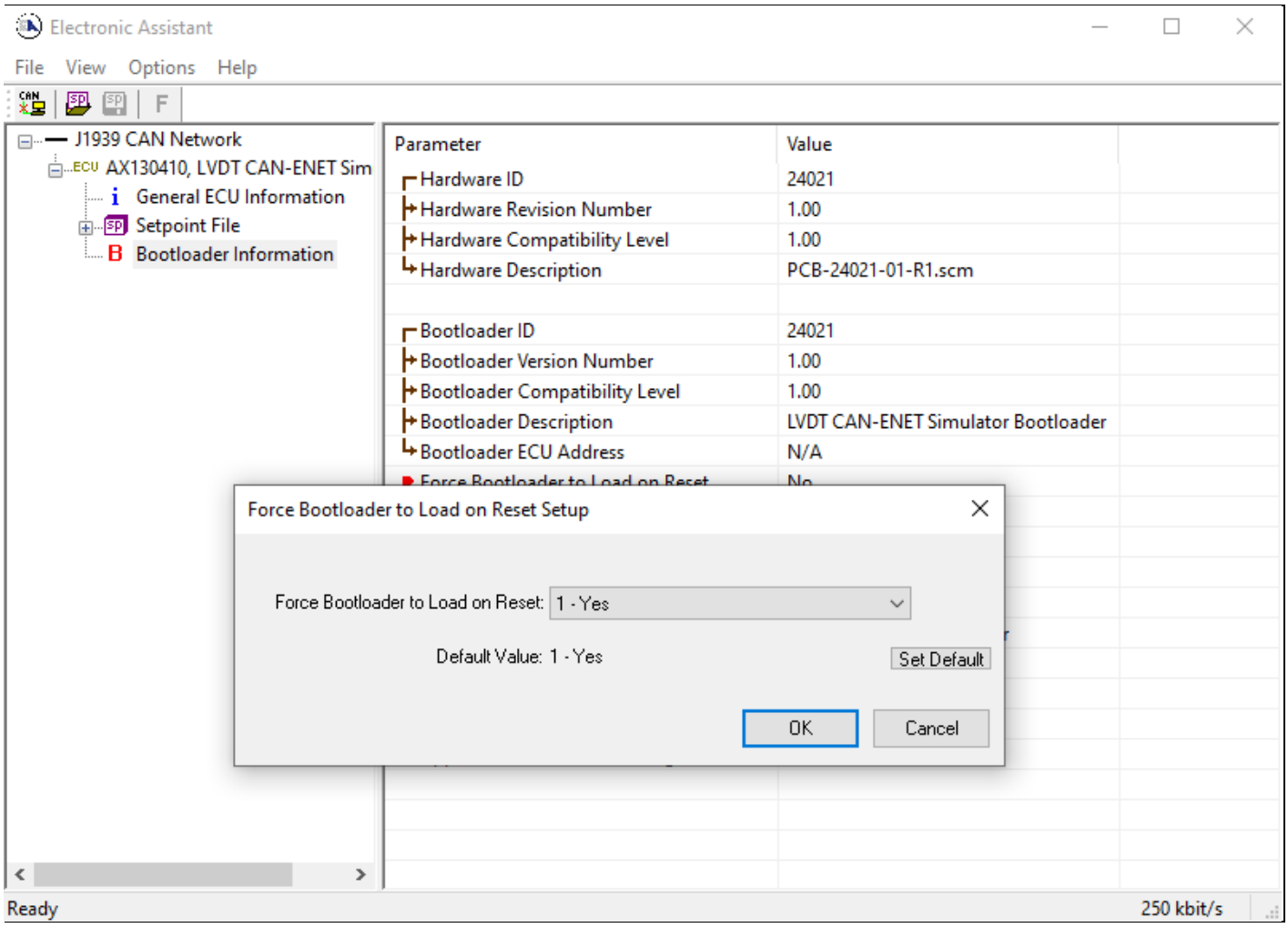


Figure 9. Bootloader Activation. First Step

The EA will prompt the user to change the *Force Bootloader to Load on Reset* parameter flag to “Yes”. This will automatically activate the bootloader on the next ECU reset. After accepting the change, the next screen will ask the user if the reset is required. Select “Yes”.

After automatic reset, instead of the firmware info, the user will see *J1939 Bootloader* ECU in the *J1939 CAN Network* top-level group in the EA. This means that the bootloader is activated and ready to accept the new firmware.

All the bootloader specific information: controller hardware, bootloader details, and the currently installed application firmware remains the same in the bootloader mode and the user can read it in the *Bootloader Information* group screen, see Figure 10. The information can be slightly different for different versions of the bootloader.

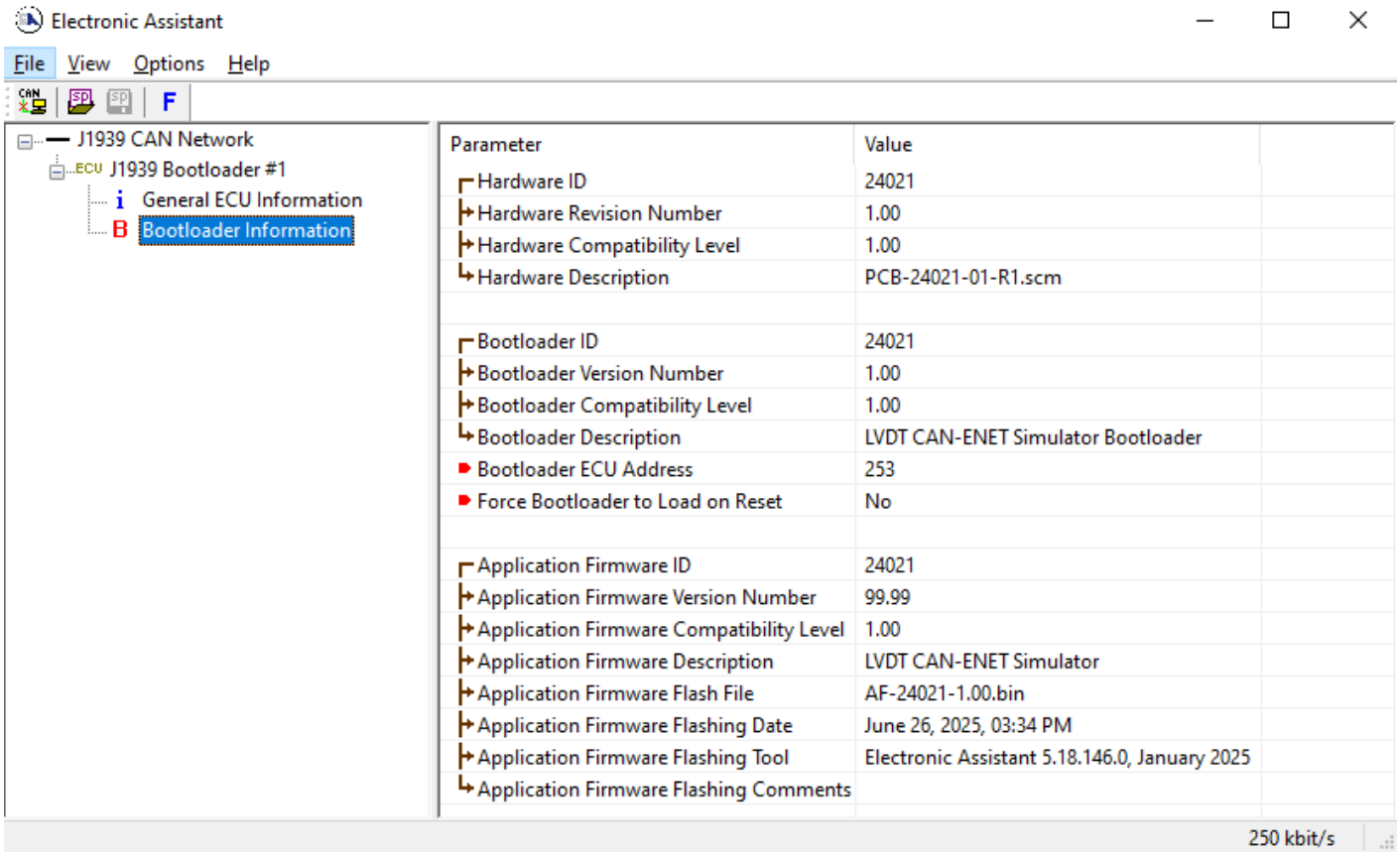


Figure 10. Bootloader Information Screen

At this point, the user can return to the installed controller firmware by changing the *Force Bootloader to Load on Reset* flag back to *No* and resetting the ECU.

To flash the new firmware, the user should click on F toolbar icon or from the *File* menu select the *Open Flash File* command. The *Open Application Firmware Flash File* dialog will appear. Pick up the flash file with the new firmware and confirm the selection by pressing the *Open* button. The *Flash Application Firmware* dialog window will appear, see Figure 11.

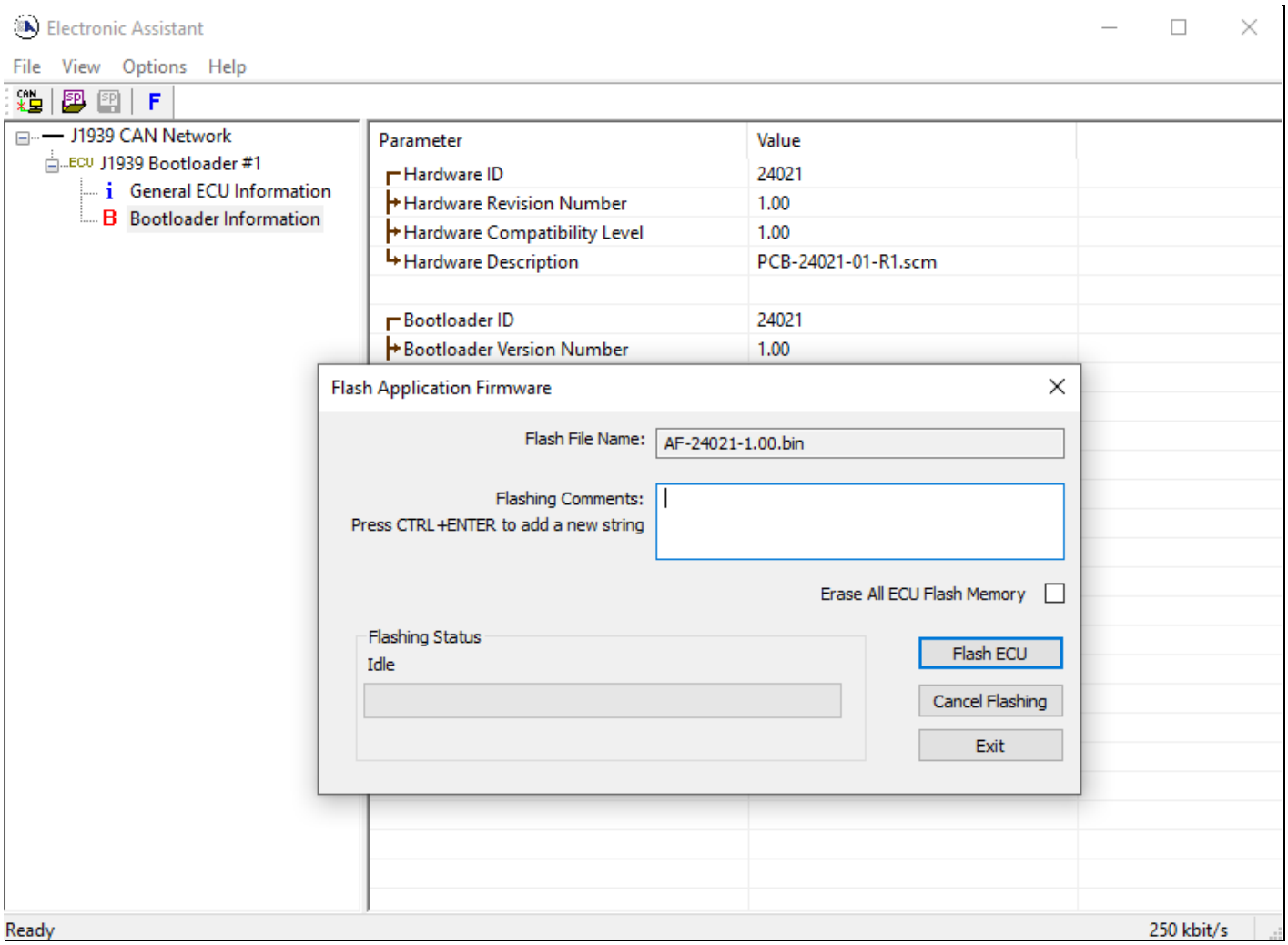


Figure 11. Flashing New Firmware. Preparation

Now the user can add any comments to the flashing operation in the *Flashing Comments* field. They will be stored in the *Bootloader Information* group after flashing.

The user can also check the *Erase All ECU Flash Memory* flag to erase all flash memory.

Select the *Flash ECU* button to start flashing. A reminder that the old application firmware will be destroyed by the flashing operation will appear. Press *Ok* to continue and watch the dynamics of the flashing operation in the *Flashing Status* field. When flashing is done, the following screen will appear prompting the user to reset the ECU, see Figure 12.

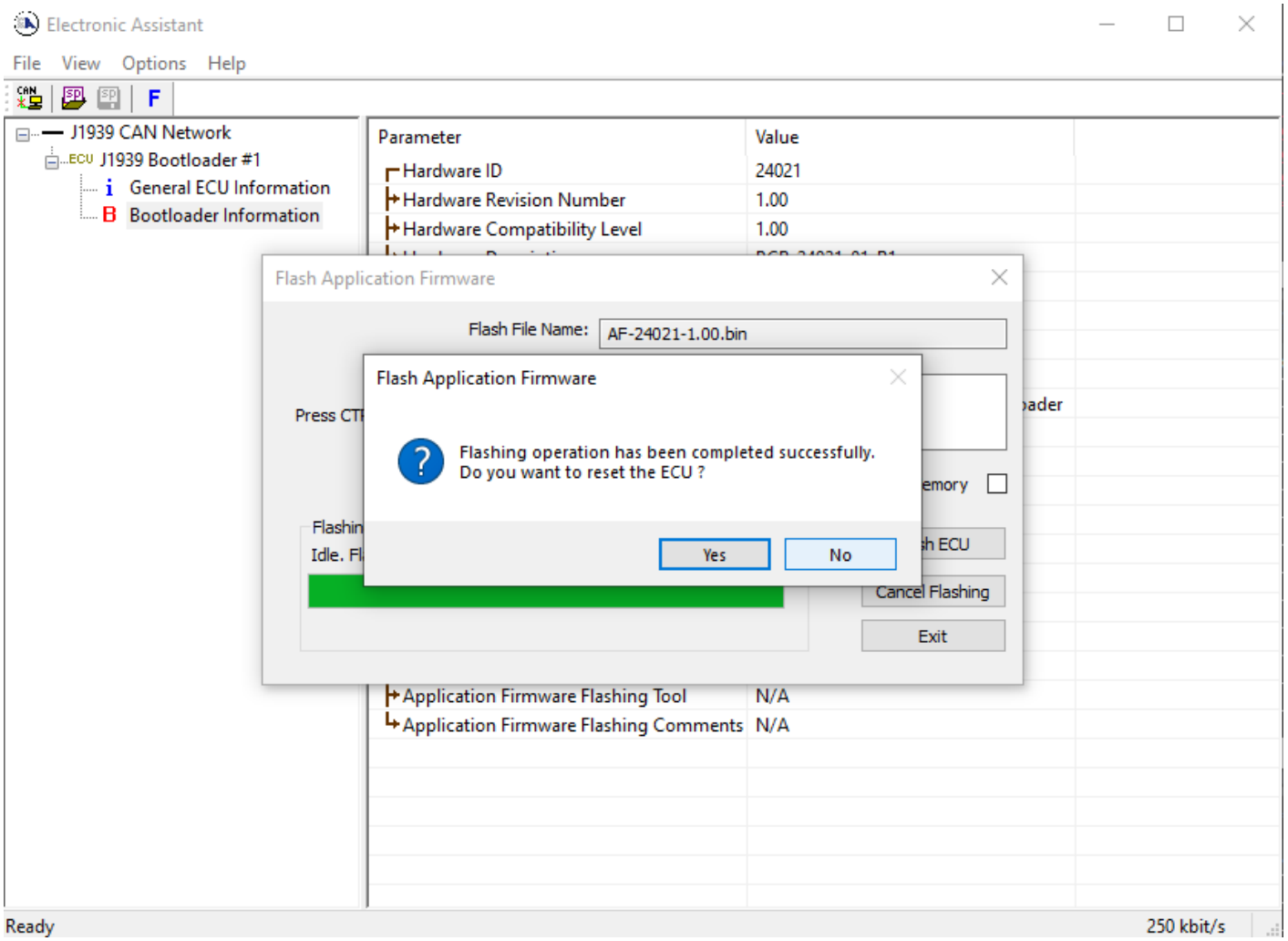


Figure 12. Flashing New Firmware. Final Reset.

Select *Yes* and see the ECU running the new firmware, see Figure 13. This will indicate that the flashing operation has been performed successfully.

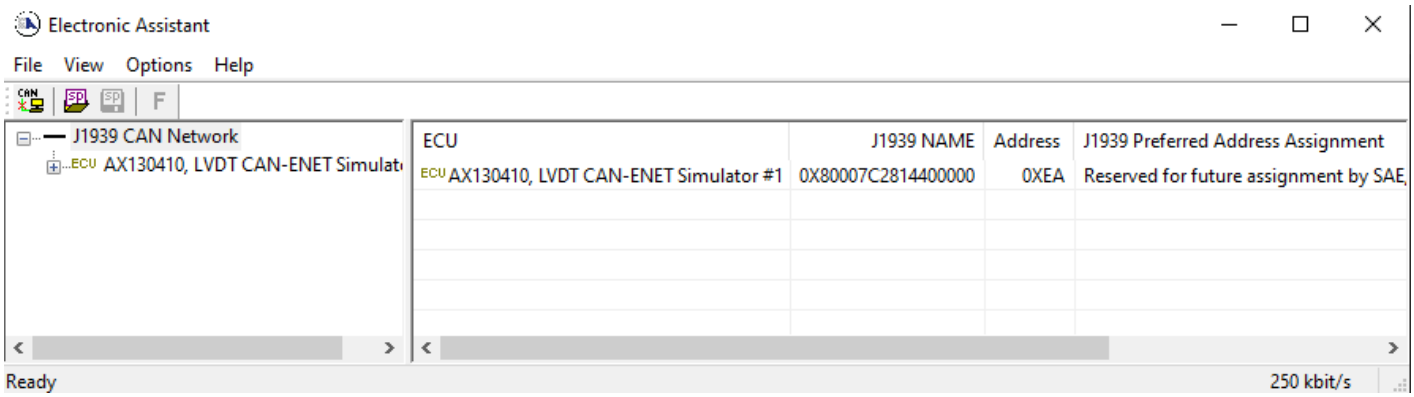


Figure 13. Firmware has been Updated. New Firmware Screen

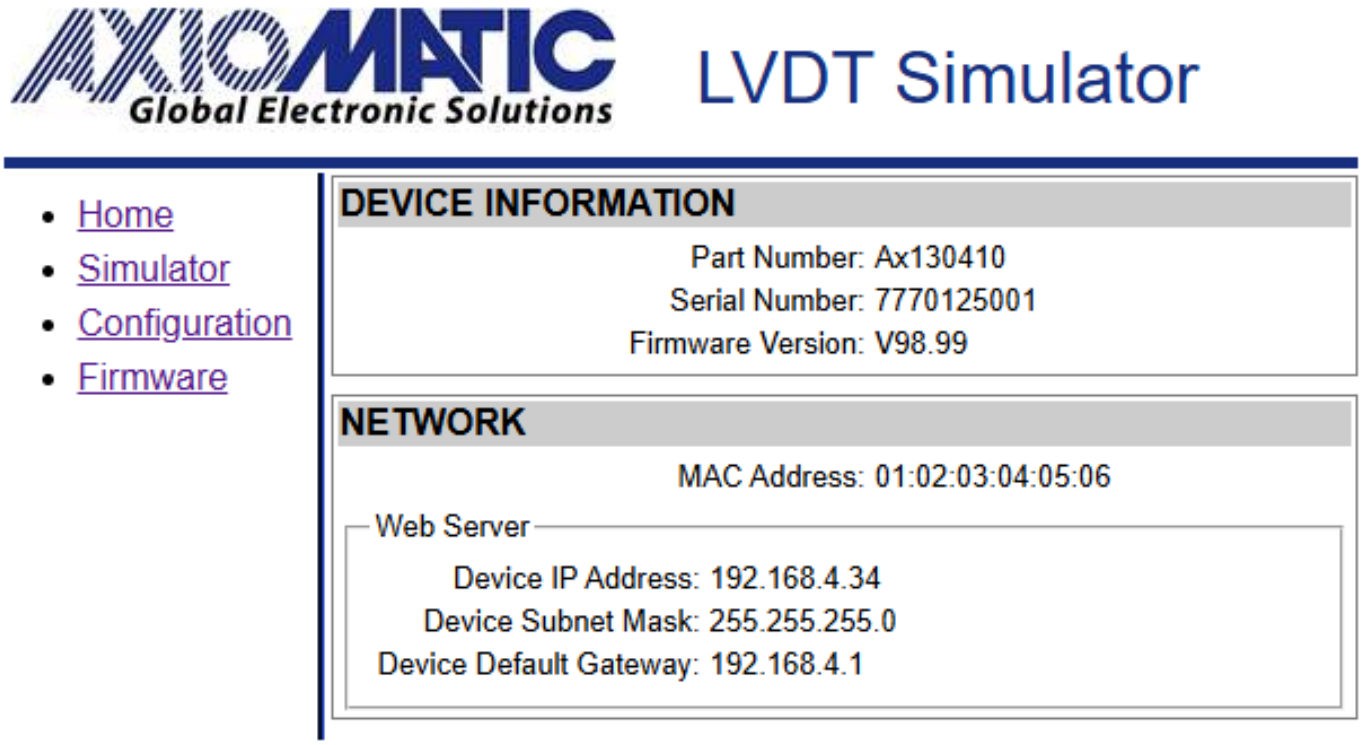
For more information, see the *J1939 Bootloader* section of the EA user manual.

6. WEB BROWSER BASED CONTROLLER CONFIGURATION

The LVDT Simulator supports configuration of the data routing parameters from Ethernet port using a standard web browser.

6.1. Device Information

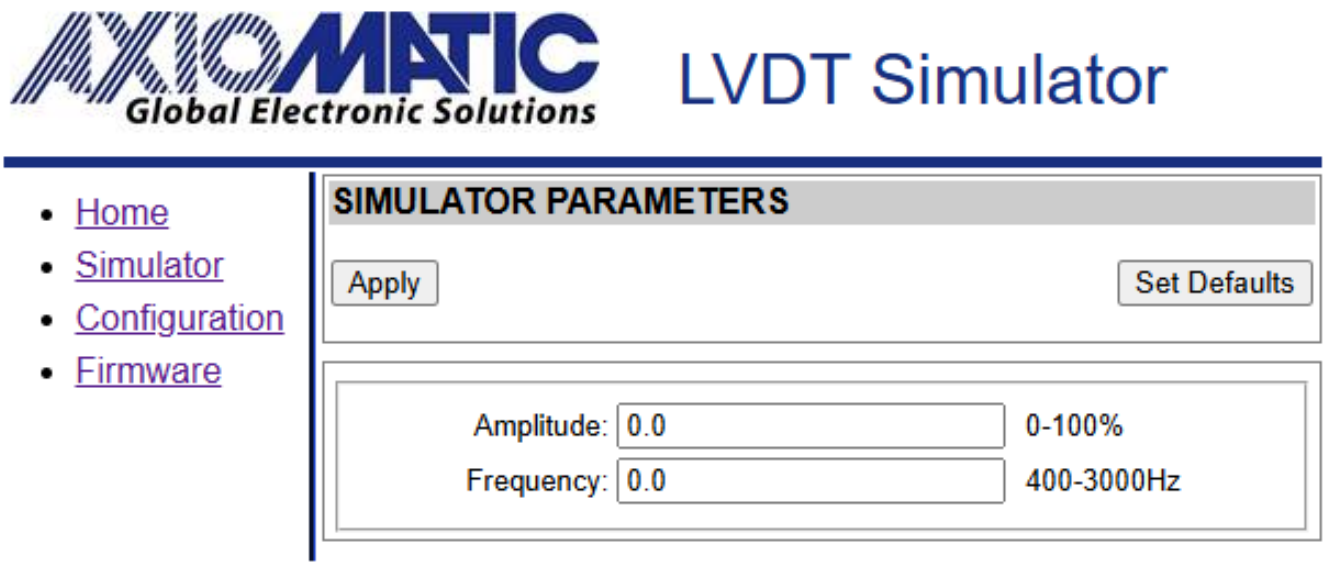
The LVDT Simulator has a web server running on TCP port 80.



The Home page gives an overview of the device status information. This page contains no editable settings.

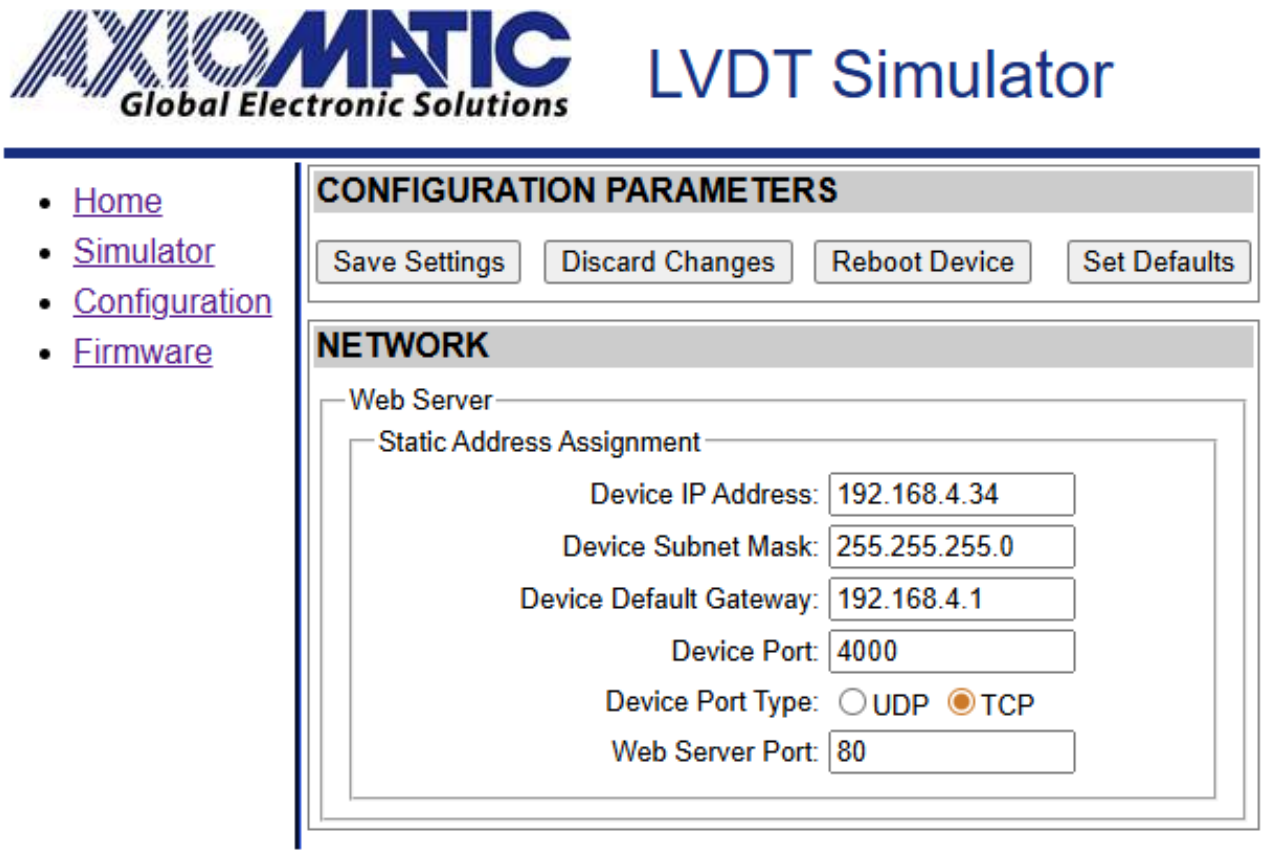
6.2. Simulator

The Simulator Parameters are defined in Section 1.1. Please refer to detailed information about how these fields are used.



6.3. Configuration

The Configuration Page allows you to reboot and set default parameters of the controller:



6.4. Firmware update

The device firmware can be updated through the internal website in the field.

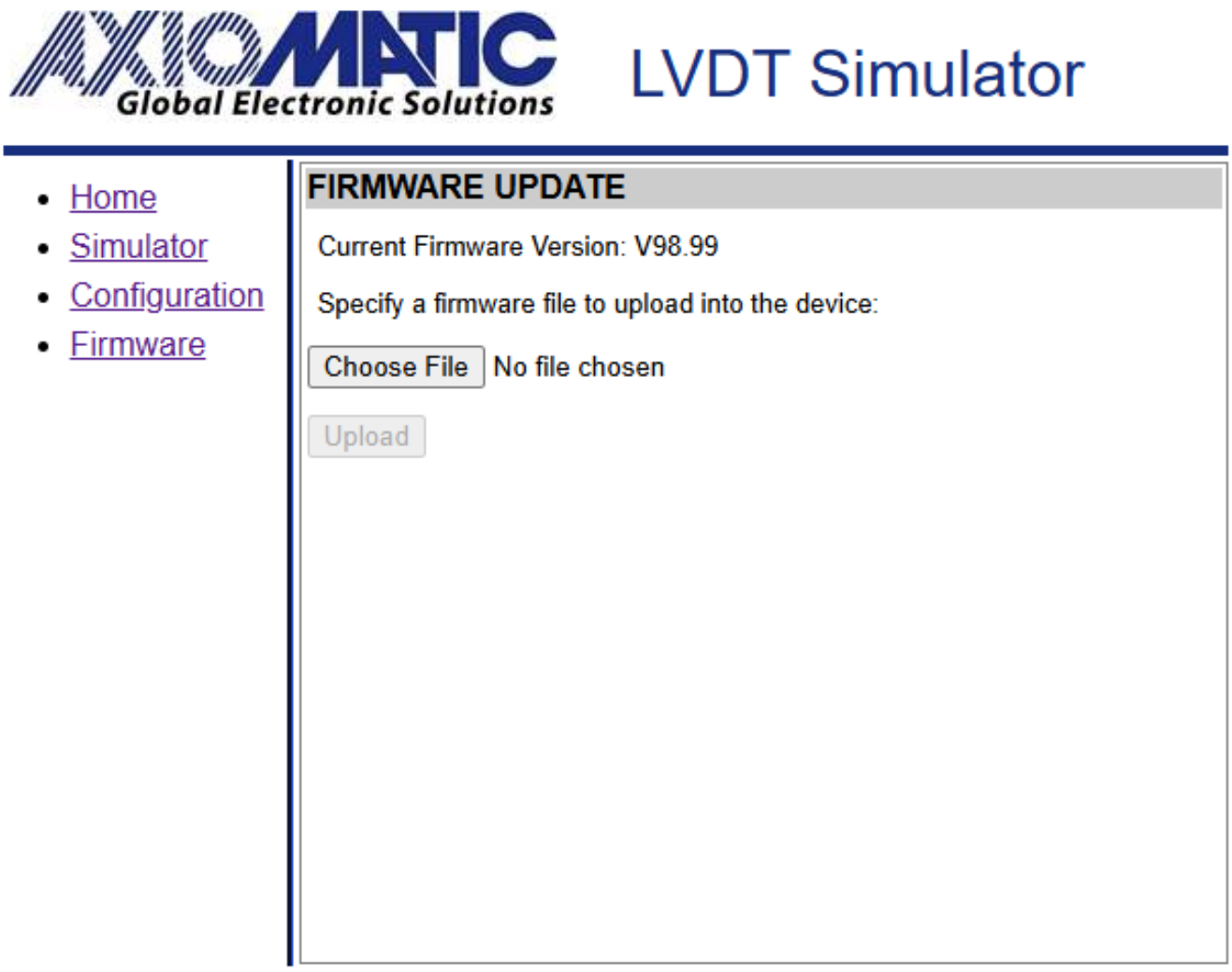
The update procedure is performed in two stages. First, the application firmware is uploaded into internal flash. During this stage, the device checks the firmware checksum and whether it can be programmed into the unit.

Then, upon the user confirmation, the firmware is programmed into the microcontroller, and the unit is restarted. At the end of this process, the user should see the new firmware version number on the home page in the browser.

The details of the firmware update are provided below.

6.4.1. Uploading the New Firmware

To upload the new firmware, the user should activate the *Firmware Uploading* page by clicking on the *Firmware* link on the left side of the webpage[1].



[1]Please note that the *Current Firmware Version* number in the figures below may be different from the firmware version number described in the manual.

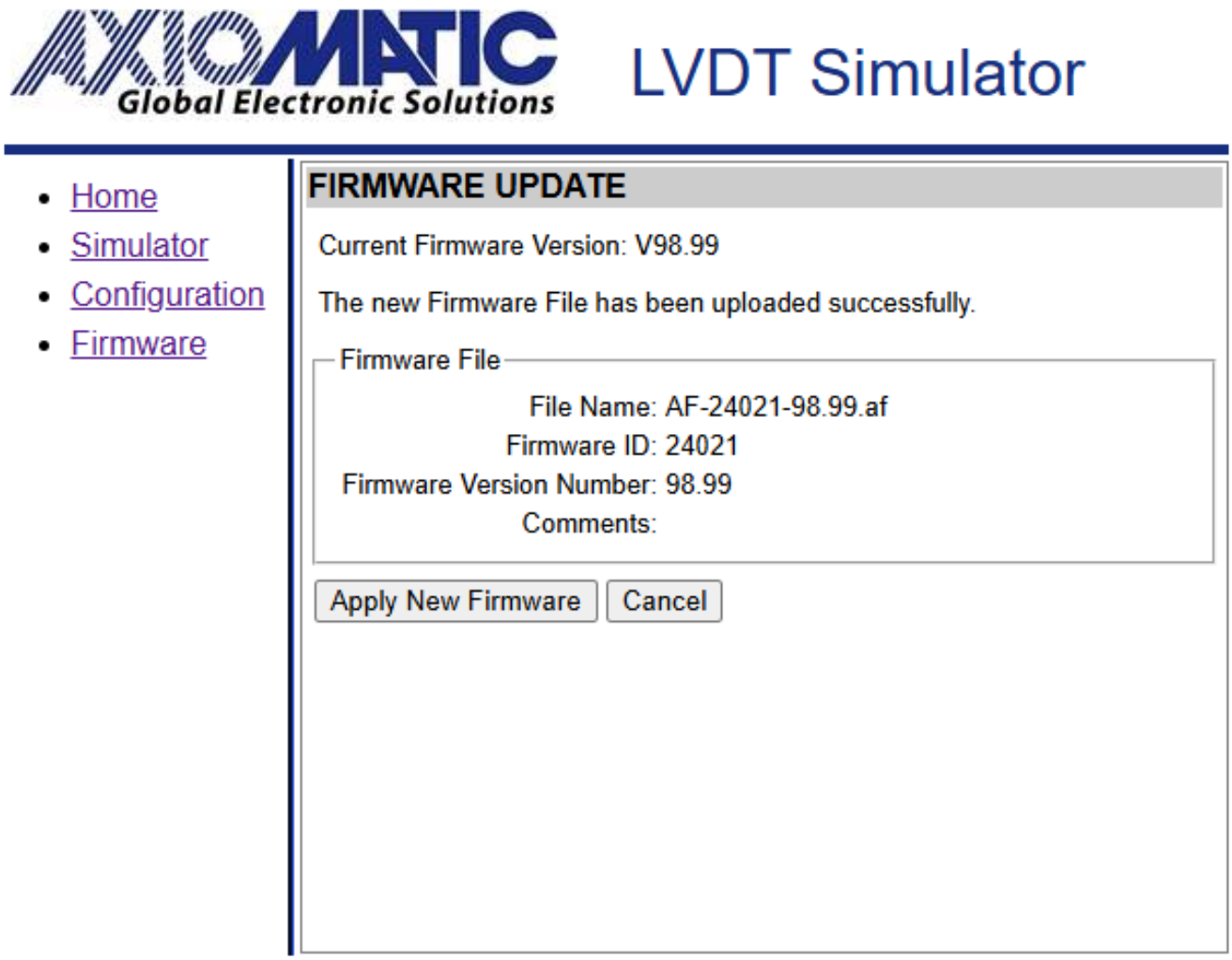
Then the user selects the new firmware file using the *Choose File…* button.

The firmware file is provided by Axiomatic in a proprietary binary format with extension: `.af`. The file name should have the following format: `AF-24021-X.XX.af`, where the `<X.XX>` field wildcard reflects the firmware version number.

When the file is selected, the user should press the *Upload* button. The user will see the dynamic message: “Loading…” in the bottom of the screen and then, if everything is in order, the device will switch automatically to the *Firmware Update* page.

6.4.2. Applying the New Firmware

On the *Firmware Update* page, the user will see the new firmware file information, see below:

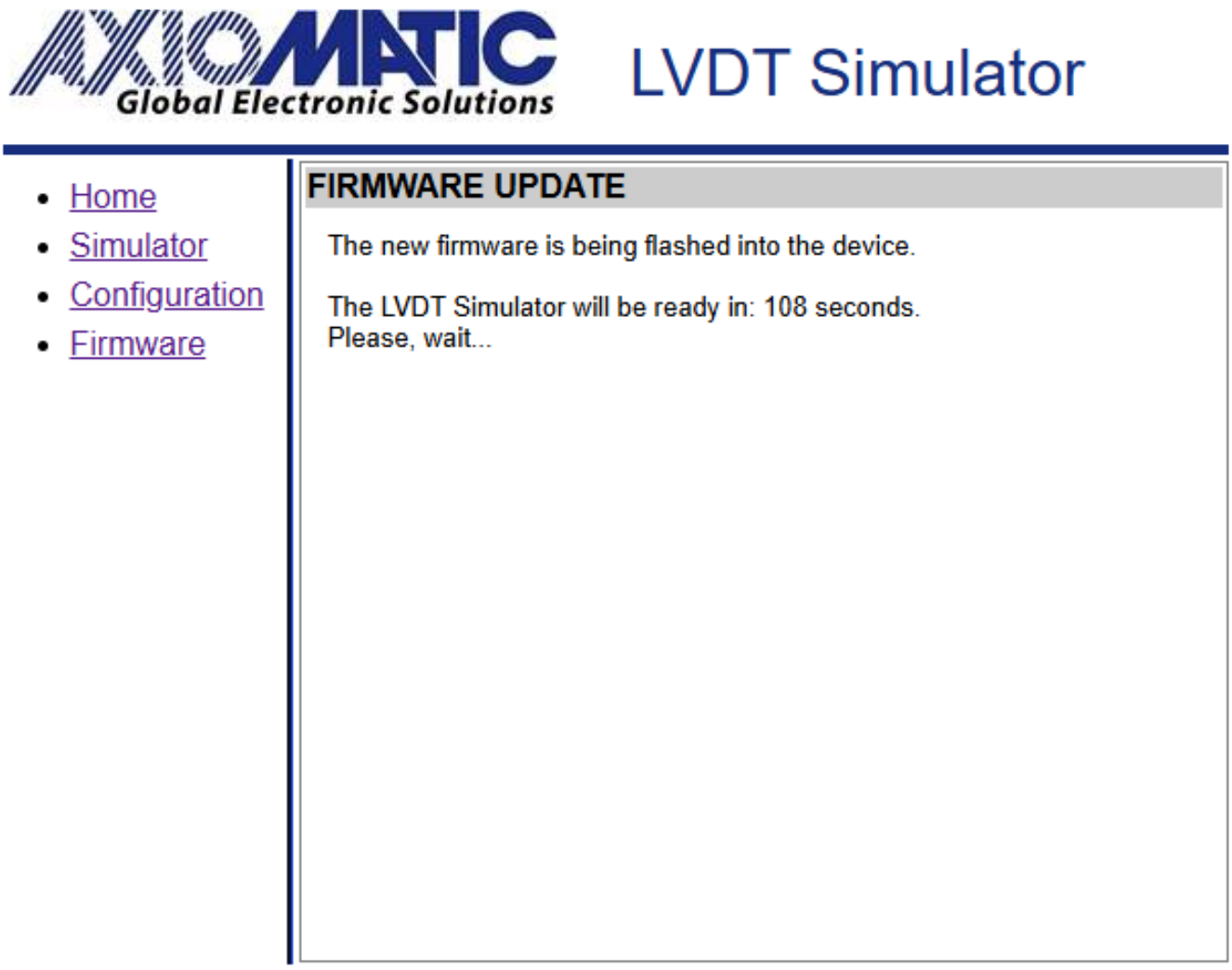


From this point, the user can cancel the firmware update process and keep the old firmware or proceed with flashing the new firmware into the microcontroller by pressing the *Apply New Firmware* button.

When the user presses the *Apply New Firmware* button, the firmware update process is activated, and the *Firmware Upload* page will show the countdown timer.

The countdown timer is set for 120 seconds necessary to complete the flashing process and reboot the unit.

The device home page will be displayed after rebooting. The user will see the new application firmware version number in the *Device Information* section on the home page.



7. USB INTERFACE

The USB menu driven text user interface can be used as a local alternative to the device CAN/web interface for configuring of the device and flashing new firmware.

7.1. Main Menu

After successful connection to a PC using any type of terminal emulation software (TeraTerm is preferred, https://teratermproject.github.io/index-en.html), the user will see the main menu, presented in Figure 14.

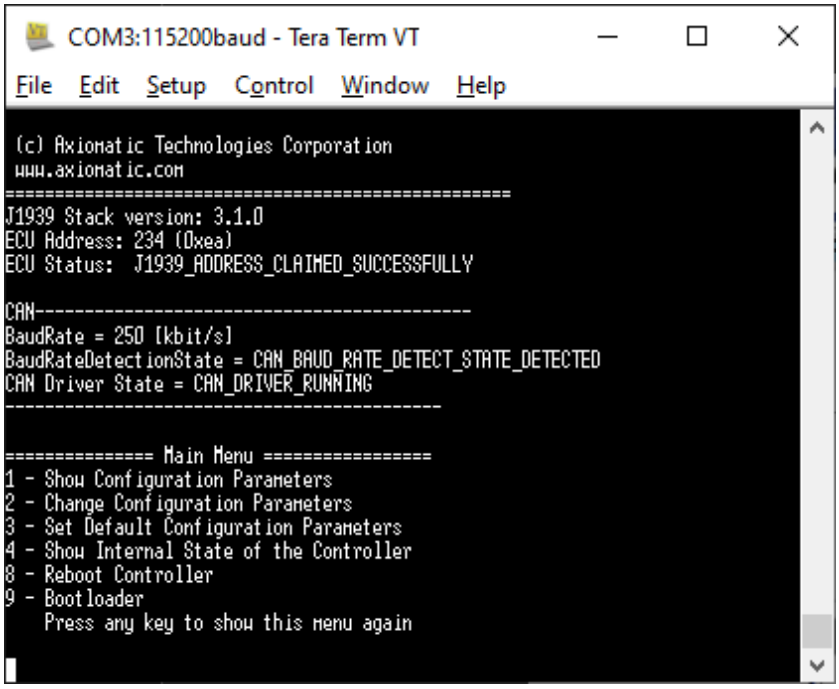


Figure 14. Main Text Menu[1]

[1]The firmware version number may be different from the firmware version described in the manual.

To activate options on the menu, the user should press the appropriate number or letter on the keyboard.

7.1.1. Show Configuration Parameters

When this option is activated, the user will see values of all configuration parameters, see Figure 15.

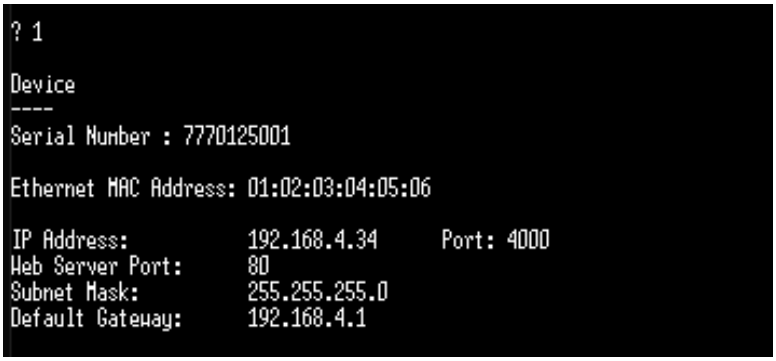


Figure 15. List of All Configuration Parameters

7.1.2. Change Configuration Parameters

The user can change the configuration parameter by activating this menu item. A list of names of all updatable configuration parameters will be presented to the user, see Figure 16.

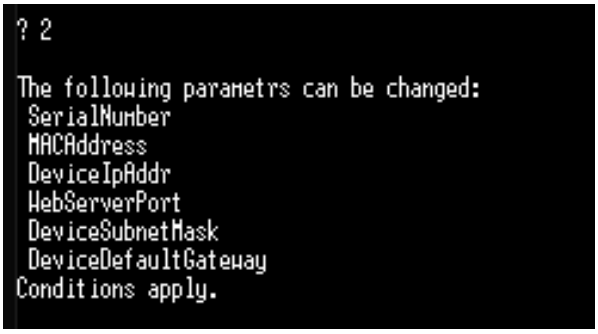


Figure 16. List of Updatable Configuration Parameters

The user then enters the name of the configuration parameter from the list and follows the prompts for changing the selected configuration parameter. For example, changing the value of *Web Server Port* configuration parameter is presented in Figure 17.

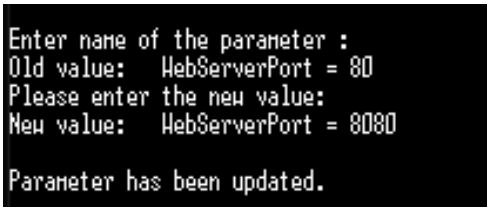


Figure 17. Changing Web Server Port Configuration Parameter

Once successfully changed, the new configuration parameter is applied immediately, without waiting for the device to be rebooted.

7.1.3. Show Internal State of the Controller

N/A

7.1.4. Set Default Configuration Parameters

The user can reset the device configuration parameters to their default values by activating this menu item and then confirming the decision by entering “Yes”, see Figure 18.

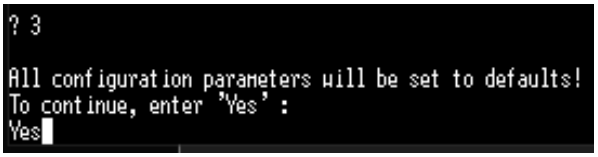


Figure 18. Setting Default Configuration Parameters

The default configuration parameters are applied immediately. No reboot is required.

7.1.5. Reboot Device

The device will be rebooted when the user activates this option.

7.1.6. Bootloader

The user can switch to the Bootloader mode using this option.

7.1.7. Load New Firmware

The user can load a new application firmware by activating this bootloader menu option. The file uploading instructions for TeraTerm will appear on the screen, see Figure 19.

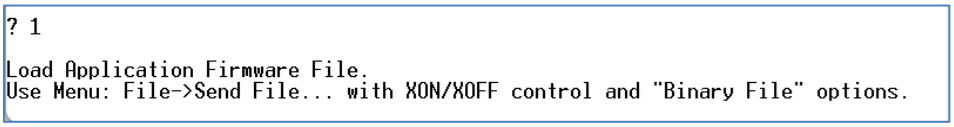


Figure 19. Load Application Firmware File Prompt

The user should pick the firmware file and start the uploading process by pressing the *Open* button, see Figure 20.

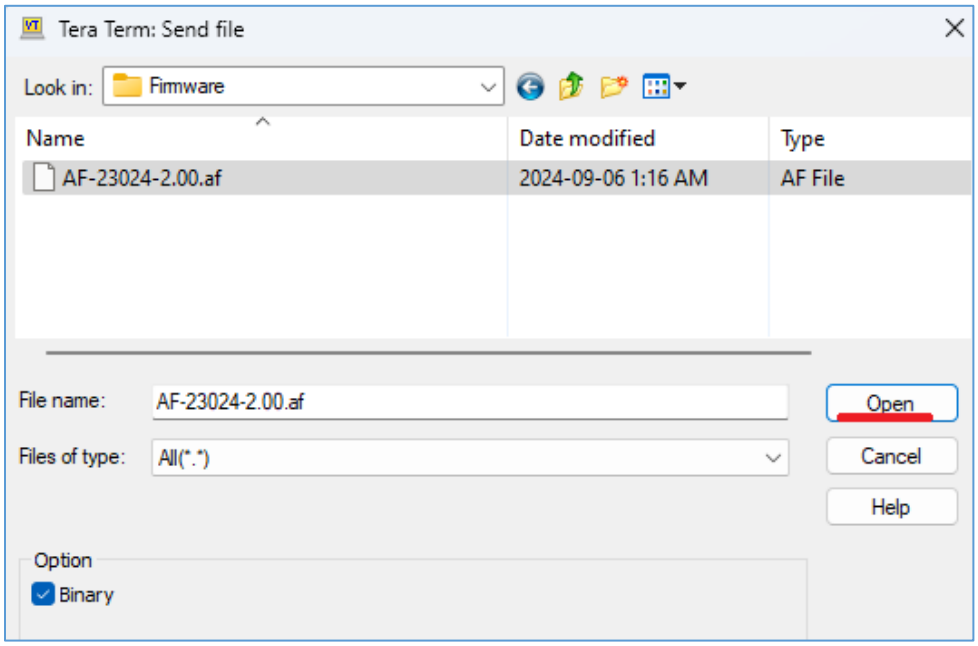


Figure 20. Selecting New Firmware

7.1.8. Reboot Device

The user will leave the bootloader by choosing this option and rebooting the device. The device main menu will be displayed after the reboot.

8. 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/.

All specifications are typical at nominal input voltage and 25°C unless otherwise specified.

Power

Power Supply Input	12 or 24 VDC nominal 9 to 36 VDC power supply range
Quiescent Current	150 mA @ 12 VDC; 80 mA @ 24 VDC
Protections	Reverse polarity protection is provided. Overvoltage protection provided. Shutdown at 4 V. Undervoltage protection provided. Shutdown at 40 V.

Outputs

LVDT Simulation Output A	Amplitude: 1 to 5 VAC (peak to peak) Fully isolated
LVDT Simulation Output B	Amplitude: 5 to 1 VAC (peak to peak) Fully isolated
Reference Output	Amplitude: 3 VAC ± 5 %
Frequency	400 Hz to 3 kHz ± 0.1 % The frequency selected will be applied to all three outputs.
Load Effect	<1% with 10 kΩ
Protection	Short circuit protection provided

Interfaces

CAN	1x CAN port (SAE J1939) Supported baud rates: 250 kbit/s (default), 500 kbit/s, and 1 Mbit/s with auto-baud-rate detection
Ethernet	1x Ethernet TCP/IP port (RJ45 connector) Auto-negotiation to automatically select the highest link-up speed (10/100 Mbps) Automatic detection and correction of polarity
USB	1x USB 2.0 port (USB Type-C connector)
User Interface	CAN Interface: Axiomatic Electronic Assistant KIT - P/N: **AX070502** or **AX070506K** Web Interface: Supports configuration of the data routing parameters from Ethernet port using a standard web browser. Can be used for firmware reflashing too. USB Interface: This text-based user interface can be used as a local alternative to the CAN and web interfaces for configuring of the device and flashing new firmware.

General Specifications

Isolation	The two LVDT simulation outputs are fully isolated. 300 Vrms
Compliance	RoHS
Protection	IP20
Operating Conditions	-40°C to 85°C (-40°F to 185°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Weight	0.265 lb. (0.120 kg)
Installation	DIN rail mounting TH 35-7.5
Enclosure	Phoenix Contact ME MAX 22,5 3-U1 KMGY – 2201538 (vented) Polyamide, cULus recognized, China RoHS Flammability rating: UL 94V-0 0.89 in. x 4.07 in. x 4.47 in. (22.6 mm x 103.4 mm x 113.7 mm) (W x H x D) Depth from top edge of DIN rail: 4.21 in. (107 mm) Refer to Dimensional Drawing
Electrical Connections	The unit has 1x **USB Type-C** (USB 2.0) connector and 1x **RJ45 (Ethernet)** connector in addition to the following 3x Phoenix 2202344 screw terminal connections.

Power and CAN (J5)

Pin	Function
1	Battery +
2	Battery -
3	CAN High
4	CAN Low

Output References (J7)

Pin	Function
1	Output Reference +
2	Output Reference -
3	Not Used
4	Not Used

Outputs (J6)

Pin	Function
1	Output A -
2	Output A +
3	Output B +
4	Output B -

9. VERSION HISTORY

User Manual Version	Firmware Version	Date	Author	Modifications
1.0.0	99.xx	June, 2025	VR	Initial release
1.0.1	99.xx	June, 2025	M Ejaz	Marketing review Updated title Updated technical specifications section
2.0.0	98.xx	November, 2025	VR	Added Ethernet, USB support
2.0.1	98.xx	November, 2025	M Ejaz	Updated hardware block diagram Updated dimensional drawing Updated technical specifications Corrected section references

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.

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