User Manual UMAX141510
Version 1.0.1
Firmware 1.xx

3x Gigabit Automotive Ethernet / 1x Gigabit Ethernet Switch

USER MANUAL

P/N: AX141510

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ACRONYMS

AF	Application Firmware
ANSI	American National Standards Institute
ARP	Address Resolution Protocol
AX	Axiomatic
BATT	Battery
bps	Bit per second
°C	Celsius (degree)
CQI	Channel Quality Indicator
DSCP	Differentiated Services Code Point
EMI	Electromagnetic Interference
IEEE	Institute of Electrical and Electronics Engineers
°F	Fahrenheit (degree)
Gbps	Gigabit per second
GND	Ground
GPL	General Public License
H	Height (for size)
HTTP	Hypertext Transfer Protocol
ICMP	Internet Control Message Protocol
IEC	International Electrotechnical Commission
in	inch
IP	Internet Protocol or Ingress Protection (for housing)
ISO	International Organization for Standardization
L	Length (for size)
LAN	Local Area Network
lbs	Pounds
LED	Light-Emitting Diode
K	kilo
kOhm	kiloohm
m	meters
mA	milliamperes
MAC	Media Access Control (address)
Mbit	Megabit
Mbps	Megabits per second
MIT	Massachusetts Institute of Technology
Mpps	Mega packets per second
mm	millimetres
N/A	Not Applicable or Not Assigned
PC	Personal Computer
PHY	Physical Layer Transceiver (Ethernet chip)
P/N	Part Number
PWR	Power
PWREN	Power Enable
QoS	Quality of service
RFC	Request For Comments
RoHS	Restriction of Hazardous Substances
RS	Recommended Standard

RTOS	Real-Time Operating System
SP	Service Pack
SSP	Software Support Package
TBD	To be Determined
TCP	Transmission Control Protocol
TDR	Time-Domain Reflectometry
TIA	Telecommunications Industry Association
TRD	Transmit/Receive Differential
UDP	User Datagram Protocol
V	Volt
VDC	Volt Direct Current
W	Width (for size)
Win	Windows

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1 INTRODUCTION

The following user manual describes architecture and functionality of the 3-Port Automotive Gigabit Ethernet with 1-Port Gigabit Ethernet Switch. It also contains technical specifications of the device.

The user manual is valid for application firmware with the same major version number as the user manual. For example, this user manual is valid for any application firmware version 1.xx. Updates specific to the user manual are done by adding letters: A, B, …, Z to the user manual version number.

The user can check the application firmware version number using the device embedded web server.

2 DEVICE DESCRIPTION

The 3-Port Automotive Gigabit Ethernet with 1-Port Gigabit Ethernet Switch is designed for industrial and automotive applications requiring high performance 100/1000BASE-T1 Ethernet connectivity.

Port[1] (Standard Ethernet Port) can be individually configured for the desired connection speed, duplex, and flow control. Port [2-4] (Automotive Ethernet Ports) can be individually configured to support Master or Slave mode with 1Gbit/s or 100Mbit/s communication speed according to IEEE 802.3bp and IEEE 802.3bw standards. The switch internal logic is not configurable, resulting in unmanaged switch functionality.

An embedded web server on Port [1] allows users to configure switch ports, monitor the device performance, download and upload configuration parameters, and update application firmware. In addition, the web server interface contains a virtual cable tester that allows users to check integrity of the switch cabling and to perform basic Ethernet cable troubleshooting.

An internal state of the switch is displayed by LEDs on the front panel of the housing.

2.1 Hardware Block Diagram

The device hardware block diagram is presented in Figure 1.

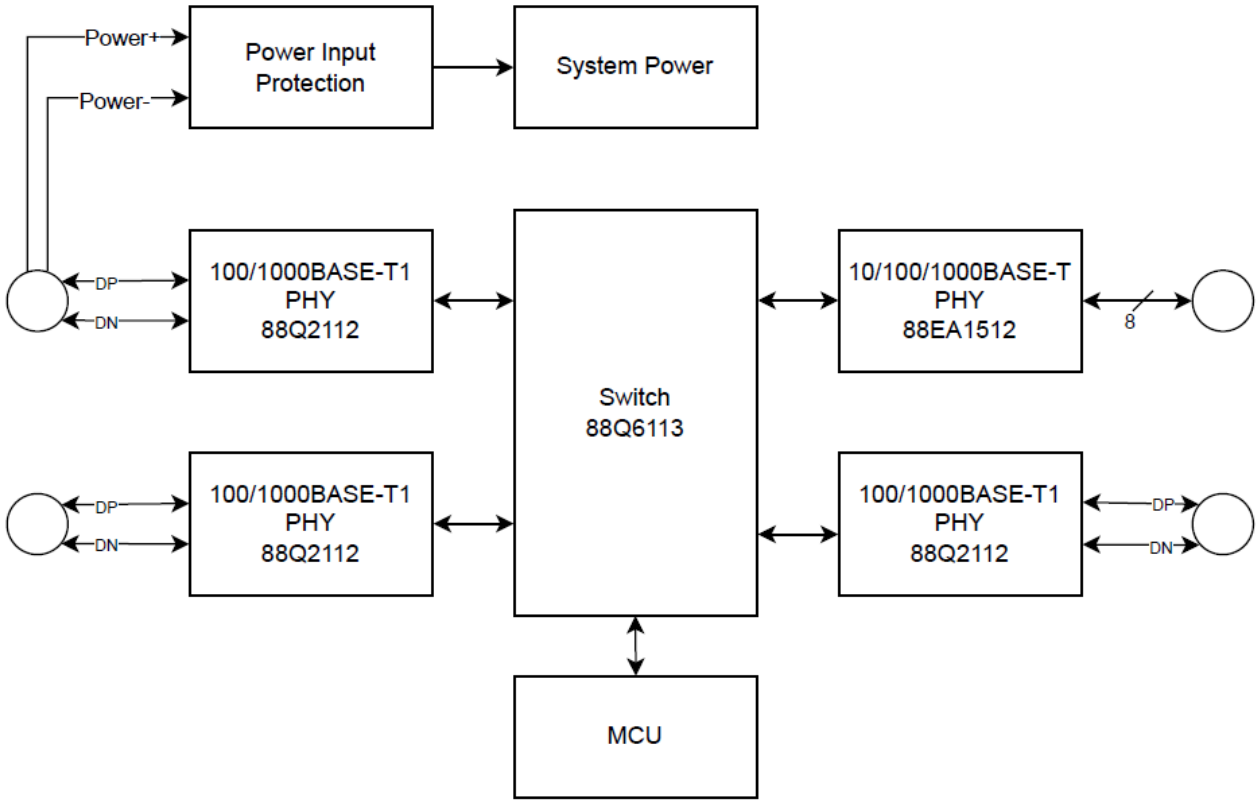


Figure 1. Device Hardware Block Diagram

The device contains one standard Gigabit Ethernet port: Port [1], three independent Gigabit Automotive Ethernet ports: Port [2-4], and a protected power supply.

The power supply has Power LED indicator. It lights up when the device is powered.

The switch core is based on Marvell Automotive Ethernet switch 88Q6113 paired with one Marvell 1Gbit/s PHY transceivers 88EA1512 and three Marvell PHY transceivers 88Q2112. Each PHY transceiver has its own Link/Activity (Link/Act) and Speed (1G/100M) LED indicators hardwired to the PHY chip.

A separate ARM Cortex-M7 microcontroller controls the switch chip and PHY transceivers and runs an embedded web server. The device configuration parameters are stored in the internal flash memory.

2.2 Device Organization

The device internal organization is presented in Figure 2.

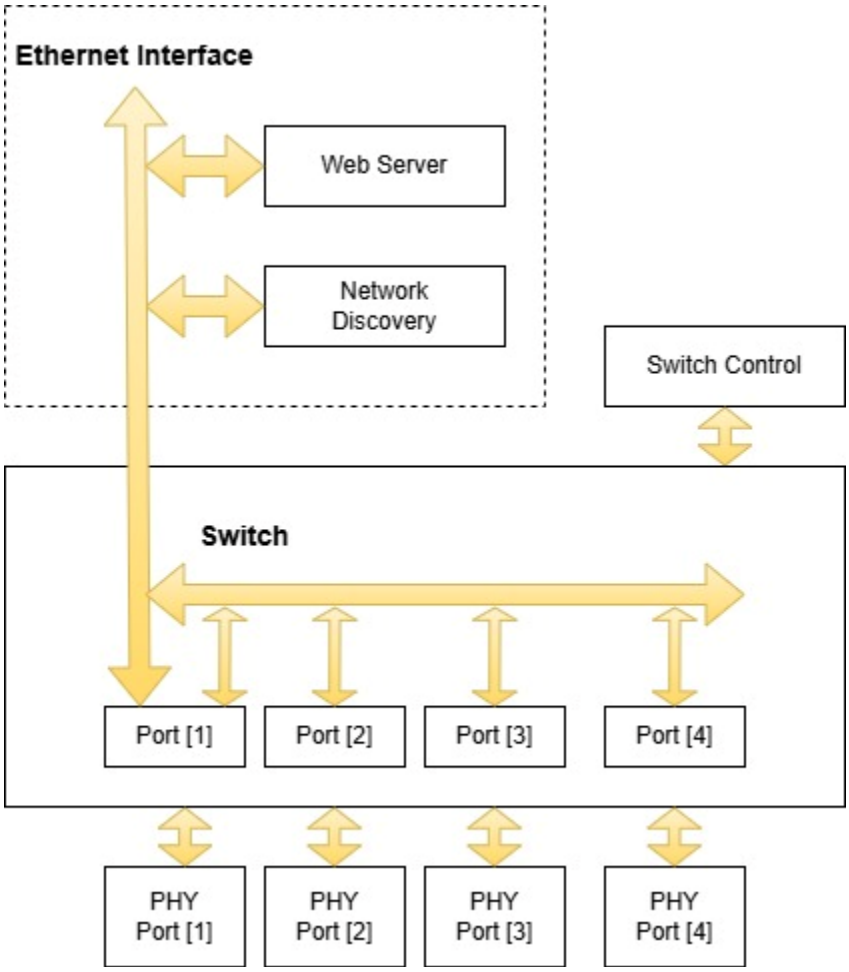


Figure 2. Device Internal Organization

The device software contains the *Switch Control* module and user interfaces: *Ethernet Interface*.

2.2.1 Ethernet Interface

The device *Ethernet Interface* is comprised of the *Web Server* and the *Network Discovery* software modules, both accessible through the switch Port #1. At the same time, the switch Port #1 can be used as a regular switch port without any restrictions.

2.2.1.1 Web Server

The device embedded web server provides a front-end user interface with the switch. It runs a dynamic website that shows the device general information, configuration parameters, and the device real-time diagnostics.

The website can be used to change, save or restore configuration parameters, change the device password, and upload new firmware. It also contains a virtual cable tester for Ethernet cable diagnostics and troubleshooting.

The user's web browser should support JavaScript.

For more information, see *Device Configuration*, *Device Diagnostics*, *Virtual Cable Tester*, and *Firmware Update* sections.

2.2.1.2 Network Discovery

The device supports a proprietary Axiomatic discovery protocol. It allows to find the device IP address on the LAN using Axiomatic discovery application `AxioDisc.exe`. For more information, see *Device Discovery* section.

3 DEVICE CONFIGURATION

The device supports configuration over the internal website running on the device embedded web server. For security reasons, the device website can be accessed only through the switch Port #1. The device web access is also password protected.

The device power should not be interrupted during updating configuration parameters to avoid possible corruption of nonvolatile memory.

3.1 Connecting to the Device

The default *Device IP Address* is “192.168.0.34”. Please, make sure that there are no other devices on this IP address when connecting the switch for the first time to your LAN for configuration.

To connect to the device, the user should run any web browser and point it to the *Device IP Address*. After a successful connection, the user will see the device login page[1], see Figure 3.

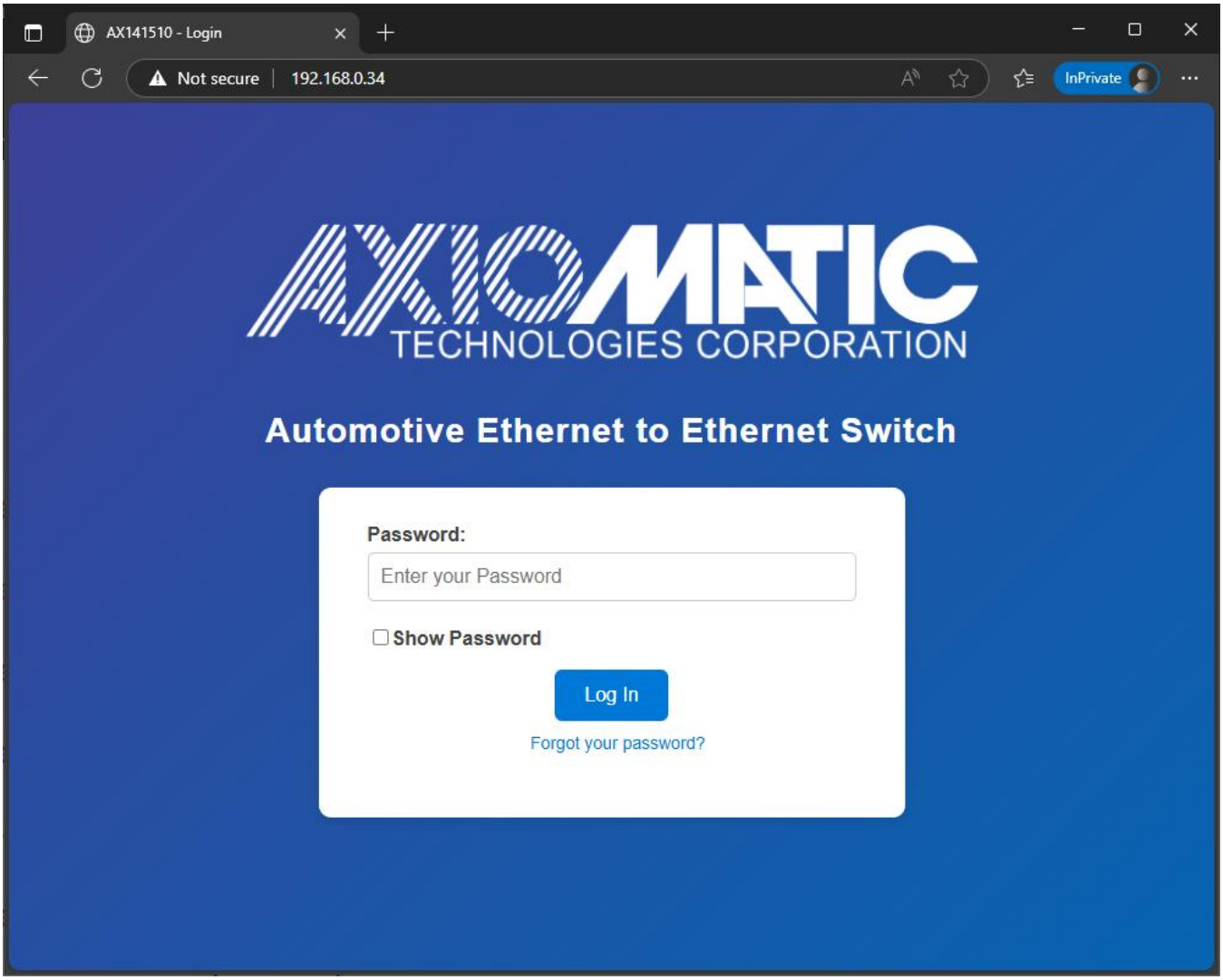


Figure 3. Device Login Page

If necessary, the user will need to allow JavaScript (this setting is default in the majority of web browsers). If JavaScript is disabled, the website will show a message asking to activate JavaScript at the top of the web page, see Figure 4.

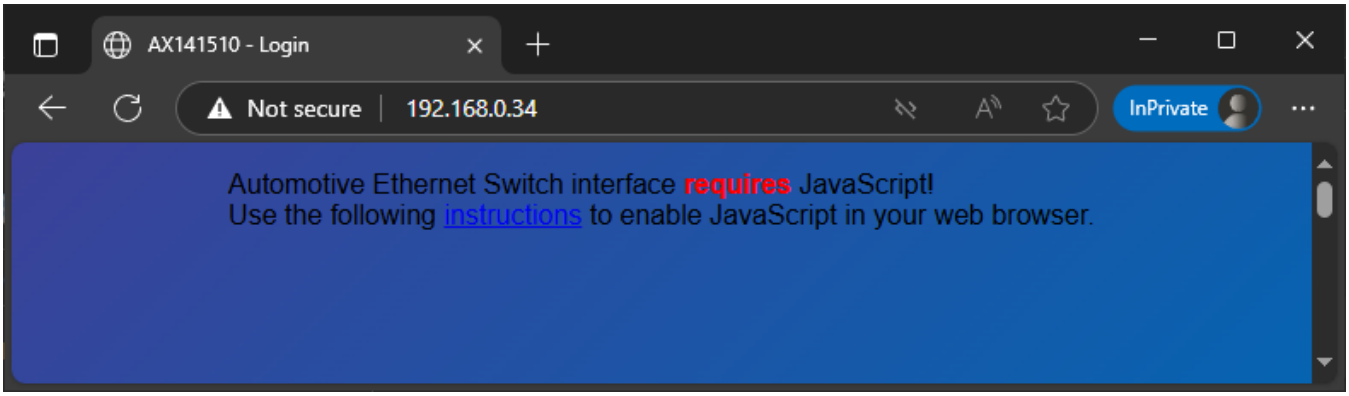


Figure 4. Enable JavaScript Prompt

The device's default password is **Axiomatic1** (case sensitive).

The device home page will be shown upon entering the correct password. The user can see the password text when *Show password* checkbox is clicked.

It is strongly advisable to change the default password to a unique one after performing the initial device setup to prevent unauthorized access to the device, see *Password Update Web Page* subsection of this document.

To protect the device from password guessing, the number of unsuccessful attempts to connect to the device is limited. Access to the device will be denied for several minutes upon reaching this limit. Also, for security reasons, the device web session will be automatically closed and the user logged out on the user's inactivity.

3.2 Device Homepage

The device home page shows the device information, including the switch part number, serial number, and firmware version, see Figure 5. It also shows the device network configuration and configuration of the automotive Ethernet and standard Ethernet ports.

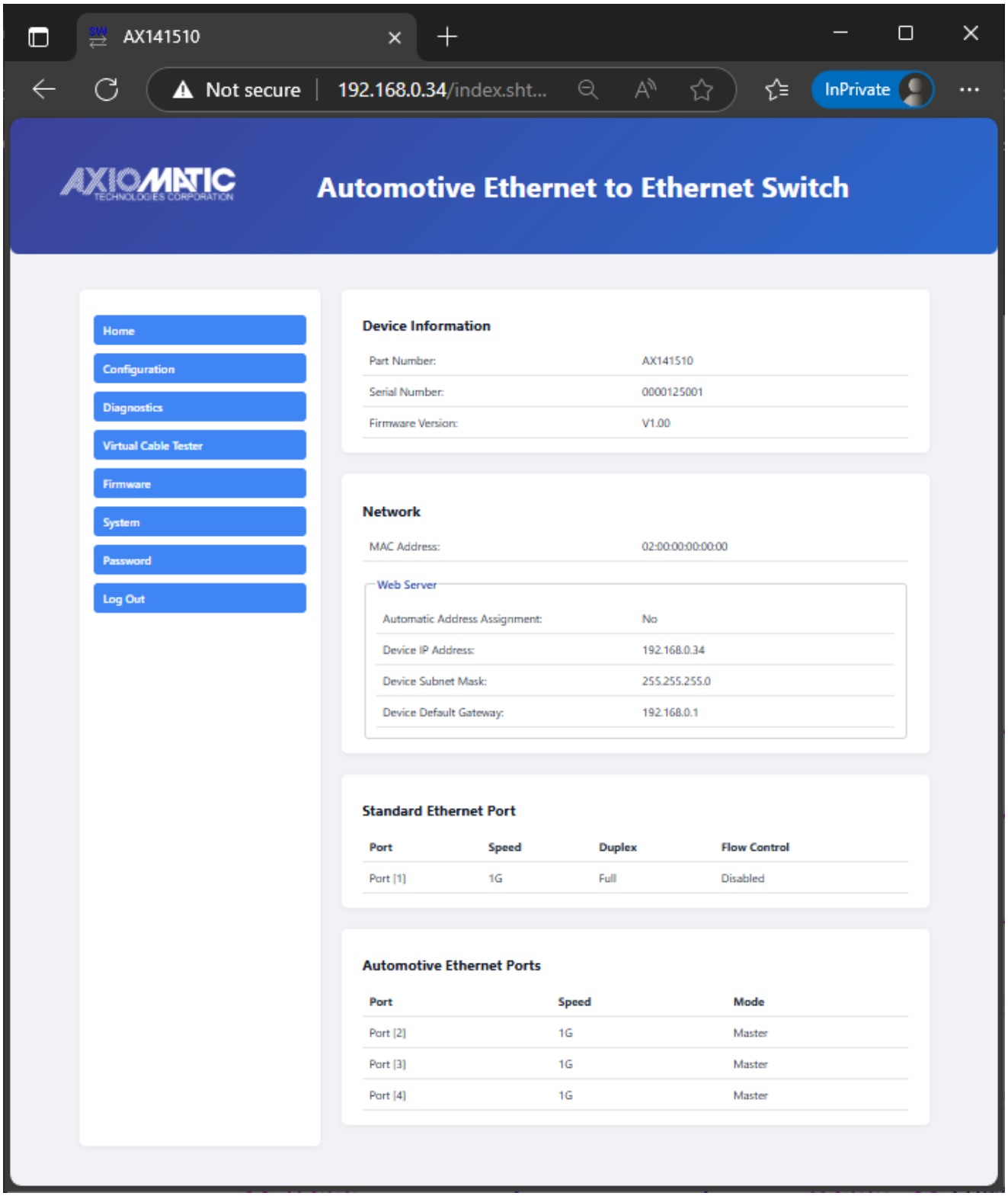


Figure 5. Device Home Page[1]

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

3.3 Changing Configuration Parameters

All configuration parameters can be changed either on an individual basis through the *Configuration* web page or by using a configuration file on the *System Settings* web page.

3.3.1 Configuration Web Page

The user can change configuration parameters in interactive mode using *Configuration* web page. It can be reached by clicking on the link on the left side of the website, see Figure 6.

The *Configuration* web page has fields to enter values of the configuration parameters and four buttons: *Save Settings*, *Discard Settings, Reboot Device* and *Set Defaults*. The configuration parameters have tooltips for the user convenience.

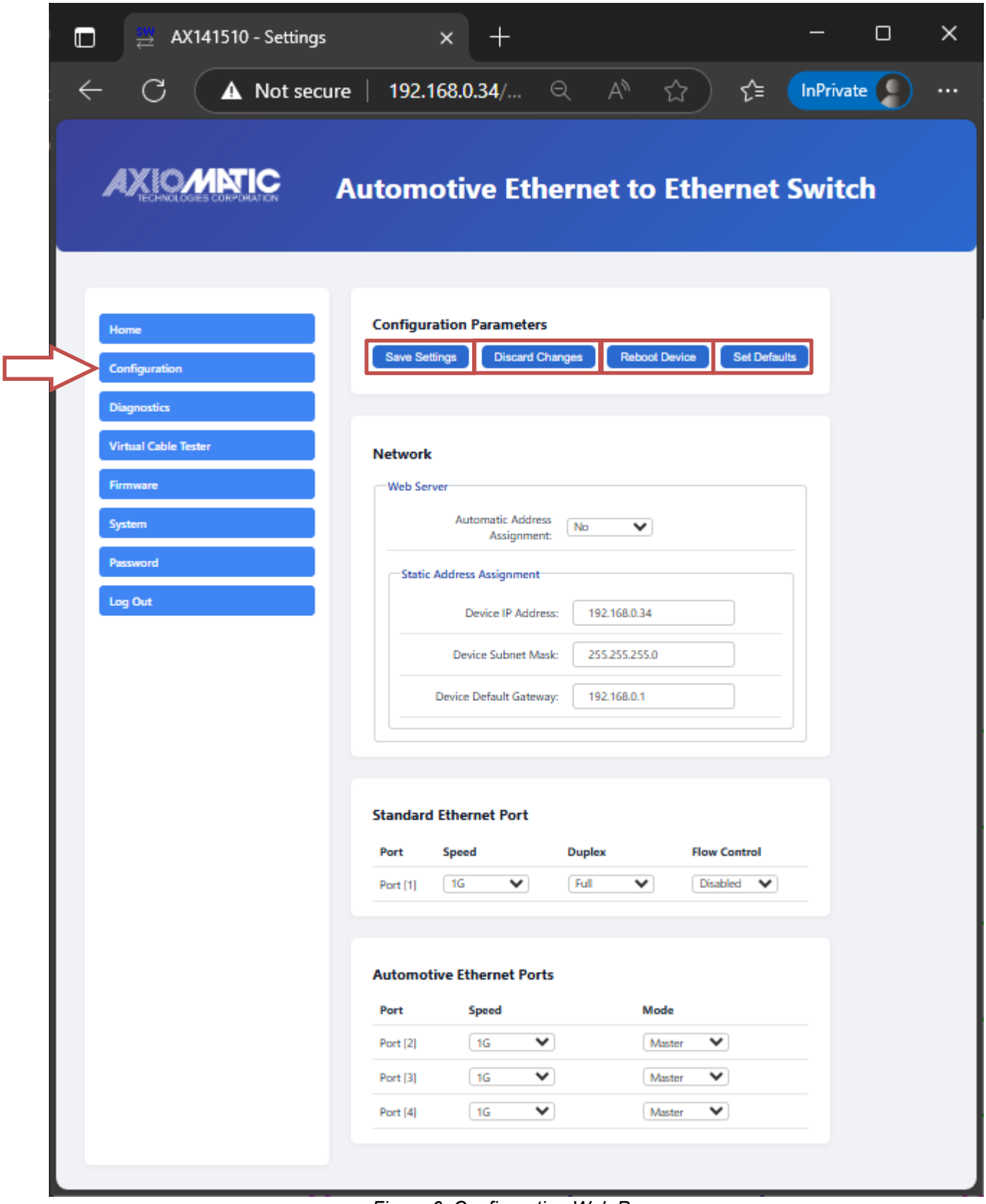


Figure 6. Configuration Web Page

The *Save Settings* button will save configuration parameters in non-volatile memory. Some changes will not be immediately applied and will require the device reboot.

The *Discard Changes* button will bring back the original device settings on the webpage before they have been changed. In case the user leaves the page without saving, all changes will be also discarded.

The *Reboot* button will reboot the device. This will activate all updates to configuration parameters stored in the non-volatile memory, if any.

The *Set Defaults* button will load default values of the configuration parameters into data fields on the configuration page. The configuration parameters will not be automatically saved.

When the user presses the *Save Settings* button, the web page runs a script to check the validity of the new configuration parameters before uploading them to the web server. For example, the following alert message will be displayed if the user enters an invalid value for the *Device IP Address*, see Figure 7.

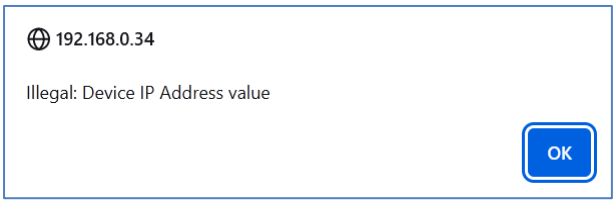


Figure 7. Settings Configuration Parameter Alert Message. Error in Configuration Parameter

The website messages should be enabled (not suppressed) in the browser to see this and other feedback messages.

After pressing the *Save Settings* button and saving the configuration parameters in non-volatile memory, the converter replies with a confirmation message showing the result of the saving operation. For example, for operations requiring reboot, the following message will be displayed, see Figure 8.

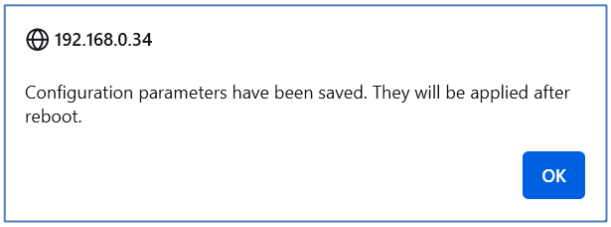


Figure 8. Settings Configuration Parameter Alert Message. Configuration Parameters have been Changed Successfully

3.3.2 Network Configuration

Network configuration parameters include *Ethernet Interface Enabled* and the web server configuration parameters, see Table 1. The converter *MAC Address*, shown on the home page, is a read-only configuration parameter.

Table 1. Network Configuration Parameters

Configuration Parameter	Default Value	Range	Description
Automatic Address Assignment	No	{No, Yes}	Automatic Address assignment using DHCP server
Device IP Address[1]	192.168.0.34	Any IP address[2]	The device static IP address
Device Subnet Mask[1]	255.255.255.0	Any IP address[3]	The device static subnet mask
Device Default Gateway[1]	192.168.0.1	Any IP address[2]	The device static default gateway

[1] Must be assigned by a network administrator when a static address assignment is used, i.e. *Automatic Address Assignment* is set to "No".
[2]Except special addresses (broadcast, multicast, etc.). The user should ensure the correctness of the IP addresses.
[3]Use a subnet mask IP address as per RFC 1878.

The web server uses a standard port number 80.

3.3.3 Automotive Ethernet Port Configuration

The user can individually change the communication speed and the negotiation role of each Ethernet port and automotive Ethernet port, see Table 2and Table 3.

Table 2. Ethernet Configuration Parameters for Port [1].

Configuration Parameter	Default Value	Range	Description
Speed	Auto	{Auto, 10M, 100M, 1G}	Port communication speed
Duplex	Auto	{Auto, Half, Full}	Port duplex setting
Flow Control	Disabled	{Disabled, Enabled}	Port flow control

Table 3. Automotive Ethernet Port Configuration Parameters for Port [2,3,4]

Configuration Parameter	Default Value	Range	Description
Speed	1G	{1G, 100M}	Port communication speed
Mode	Master	{Master, Slave}	Port negotiation role

The user should exercise cautious when using forced (manually set) *Speed* and *Duplex* combinations, unless the same combination is used on the other side of the network link. It is always advisable to use "Auto" settings on both sides of the network.

When ether *Speed* or *Duplex* is in "Auto" mode, the *Speed* and *Duplex* combination is not forced, and auto-negotiation is applied to find the best speed and duplex match between the device and its link partner on the network. The "Auto" setting for *Speed* with a forced setting for *Duplex* limits the auto-negotiation to all supported speed values with the defined duplex setting. The "Auto" setting for *Duplex* limits the auto-negotiation to all supported duplex values at the specified speed.

When the user sets *Speed* to 10Mbps or 100Mbps at a forced *Duplex* value (any value other than "Auto"), the auto-negotiation will be disabled. This will impact the flow control resolution in duplex mode, see ***Flow Control***, and also can cause duplex mismatch, see ***Duplex Mismatch***.

Please note that the forced 1Gbps half-duplex mode, available on 1G ports (port #2…5), is not supported by the majority of network equipment.

3.3.3.1 Duplex Mismatch

The duplex mismatch can happen at a legacy 10Mbps or 100Mbps speed when two connected nodes have different forced duplex settings or when one of the nodes is set to full-duplex at a forced speed and the other one is in the auto-negotiation mode for speed or duplex. In the latter case, the auto-negotiation will fail, and the node can default to half-duplex mode.[1]

[1]10 G port (port #1) will not default to half-duplex mode. It supports only full-duplex communication.

The duplex mismatch should not occur at 1Gbps due to the auto-negotiation mode being always enabled even for forced speed and duplex combinations. For speeds above 1Gbps, only full-duplex mode is available, preventing duplex mismatch as well.

3.3.3.2 Flow Control

The flow control can be enabled on any port. Ports configured for full-duplex mode use 802.3x flow control (based on PAUSE frames), and half-duplex ports use backpressure flow control.

When the *Flow Control* is "Enabled", the actual flow control configuration of the device port in full-duplex mode is based on the result of the auto-negotiation with the link partner, see Table 4. During this auto-negotiation, the device advertises both symmetric and asymmetric flow control capability.

Table 4. Device Port Flow Control Resolution in Full-Duplex Mode

Link Partner Advertisement		Device Port Flow Control	
Symmetric	Asymmetric	RxD[1]	TxD[2]
No	No	Disabled	Disabled
Yes	x[3]	Enabled	Enabled
No	Yes	Enabled	Disabled

[1]Device receives PAUSE frames from the link partner and pauses transmission accordingly.
[2]Device transmits PAUSE frames to the link partner.
[3]Any value.

In case the auto-negotiation has failed or is not performed for legacy forced *Speed* and *Duplex* combinations (when speed is 10Mbps or 100Mbps), the device will use backpressure in half-duplex mode and symmetric flow control (both: RxD and TxD are enabled) in full-duplex mode when the flow control is enabled.

3.3.4 System Settings Web Page

The device configuration can be saved and then restored back from a configuration file. The configuration file operations are provided on the *System Settings* web page, see Figure 9, accessible by clicking on the *System* link on the left side of the web page.

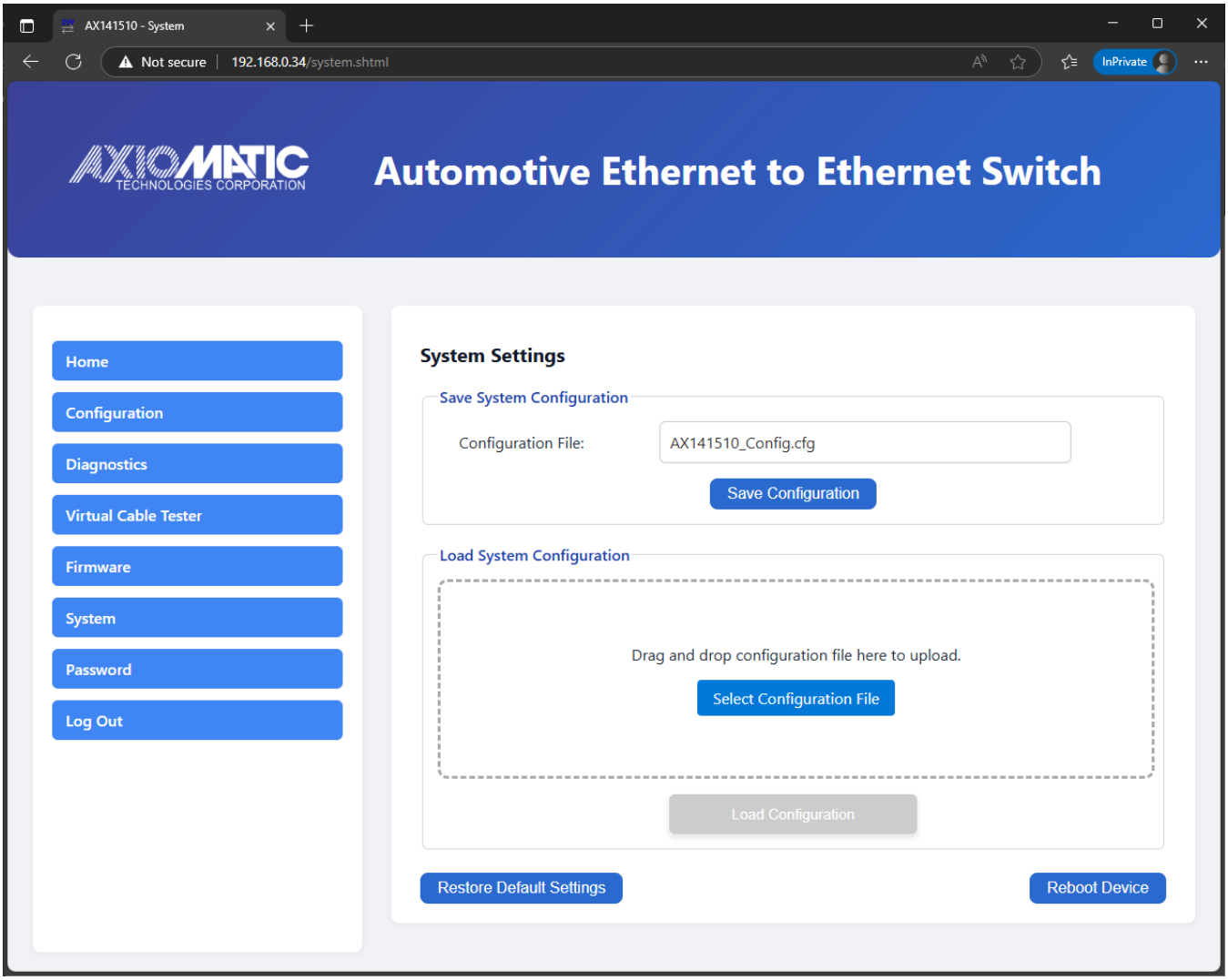


Figure 9. System Settings Web Page

3.3.4.1 Saving System Configuration

To save system configuration, the user should enter the system configuration file name in the *Configuration File* field and then press the *Save Configuration* button.

The default system configuration file name is “AX141510_Config.cfg”. The configuration file will be generated and saved in the *Downloads* location of the web browser, see Figure 10.

In case the web session is expired on inactivity, an empty configuration file will be generated.

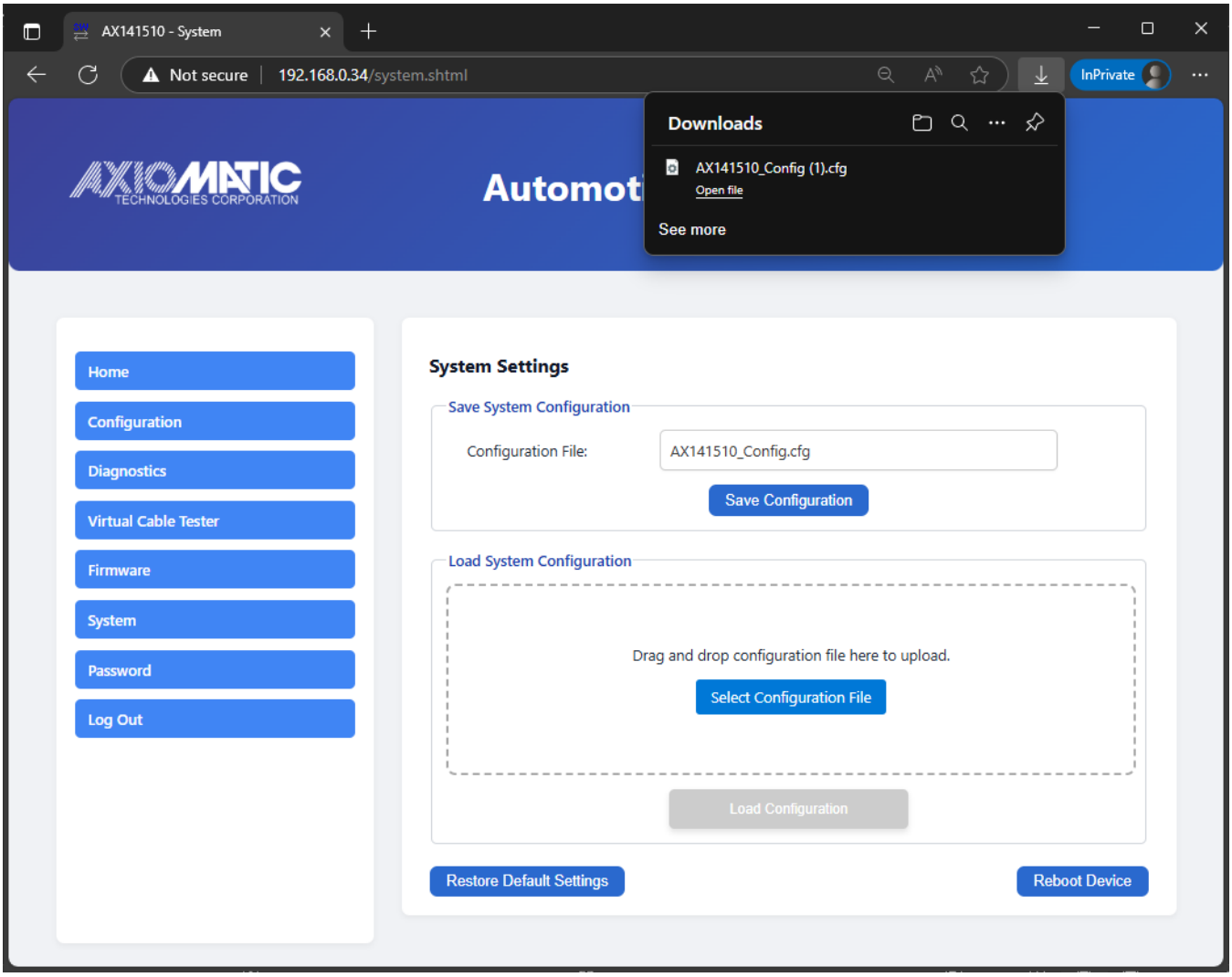


Figure 10. Saving System Configuration

3.3.4.2 Loading System Configuration

The user can restore system configuration from a configuration file. The configuration file will be processed, and configuration parameters updated during the file upload operation.

To upload the device configuration file, the user should first select the configuration file by pressing the *Select Configuration File* button in the *Load System Configuration* group on the *System Settings* web page. Also, user could just drag and drop the configuration file to the dropping area. Then the user should press the *Load Configuration* button to upload the selected configuration file to the device.

The result of the upload operation will be shown to the user in an alert message from the web site. For example, a successful upload of previously saved configuration parameters will result in the following message, see Figure 11.

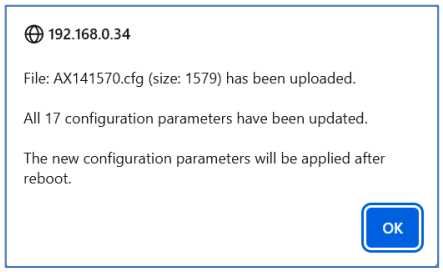


Figure 11. Loading System Configuration File Alert Message.
All Configuration Parameters Have Been Updated

The device upload operation provides extended diagnostic information to the user. In case of an error in the configuration file, a detailed description and location of the error will be reported. Similarly, the exact number of the updated configuration parameters will be reported on a successful operation, together with the total number of the device configuration parameters that could have been updated.

For example, a syntax error in the *SwitchPort2Mode* configuration parameter, when instead of *SwitchPort2Mode* an incorrect *SwitchPort2Mode** name is written, will result in the following error message, see Figure 12.

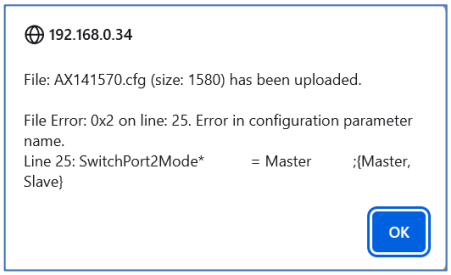


Figure 12. Loading System Configuration File Alert Message.
Error in Configuration File

This message contains a file error number, an error description, and a line number where this error was found in the configuration file. The file line content is also shown to facilitate debugging of the configuration file.

An error in the value of a configuration parameter is presented the same way. For example, if the *SwitchPort2Mode* configuration parameter has an incorrect value of “Master1” instead of “Master”, the following error message will be generated, see Figure 13.

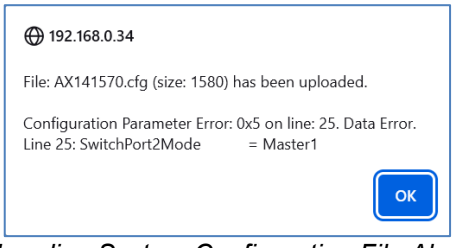


Figure 13. Loading System Configuration File Alert Message.
Error in Configuration Parameter Value

In case a configuration file has successfully updated, for example, only 16 configuration parameters out of the total 17 updatable device configuration parameters, the result message will show this information, see Figure 14.

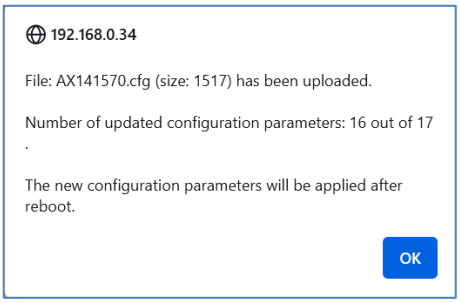


Figure 14. Loading System Configuration File Alert Message. Configuration Parameters Have Been Partially Updated

The user will need to reboot the device to apply the new configuration parameters already saved in non-volatile memory after a successful upload operation. This can be done by using the *Reboot* button on the *System Settings* web page.

All changes in configuration parameters will be rolled back if the upload operation has failed.

3.3.4.3 Restoring Default Settings

The user can restore the device to the factory default configuration by pressing the *Restore Default Settings* button on the *System Settings* page, see Figure 15.

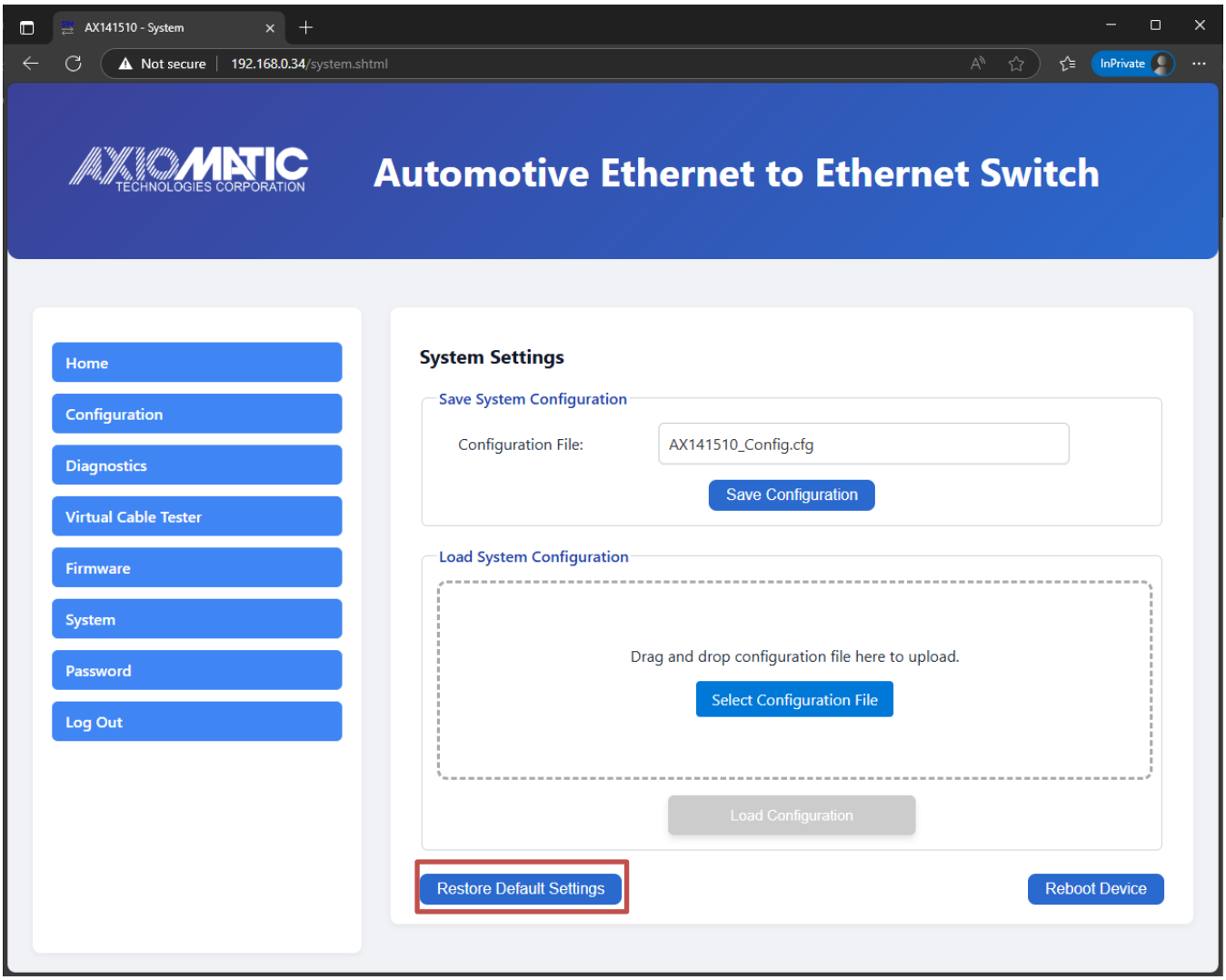


Figure 15. System Settings Page. Restore Default Settings

This operation complements the *Set Defaults* operation on the *Configuration Web Page*. The main difference is that the *Restore Default Settings* operation restores all device configuration parameters, not only the ones presented on the *Configuration Web Page*. The exception is the device password, which is not affected by this operation.

The confirmation alert message will appear to protect the device configuration from accidental modification, see Figure 16.

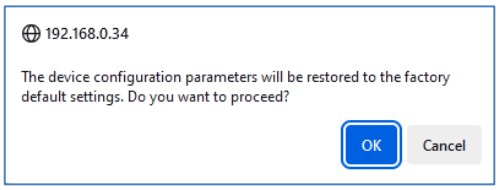


Figure 16. Restoring Default Settings Confirmation Alert Message

If the user chooses to proceed, the second alert message will inform the user of the result of this operation, see Figure 17.

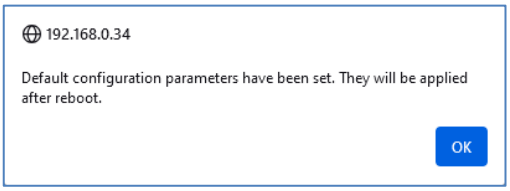


Figure 17. Restoring Default Setting Successful Result Alert Message

3.4 Configuration File Format

The device configuration is stored in a human-readable text file based on a proprietary implementation of the well known INI file format, https://en.wikipedia.org/wiki/INI_file.

The device configuration parameters are grouped in configuration parameter groups that form INI file sections. The user can edit a configuration file generated by the device in any text editor and change values of configuration parameters according to the user's requirements.

A device configuration file generated by the device with default configuration settings is presented in Figure 18.

```
; Device Configuration File
; ------------------------
; File format v1.00. Copyright (c) 2025 Axiomatic Technologies
Corporation.

[Info]
; This information group was automatically generated by the device.
; All configuration parameters in the device "Info" group are read-only.
PartNumber                = AX141510
SerialNumber              = 0000125001
MACAddr                   = 02:00:00:00:00:00
FirmwareID                = 24025
FirmwareVersionNumber     = 1.00

[Controller]

[Ethernet]
EthIntEnable              = 1               ;{1-Yes, 0-No}
AutoAddrAssign            = 0               ;{1-Yes, 0-No}
DeviceIpAddress           = 192.168.0.34    ;{Any IP Address: x.x.x.x}
DeviceSubnetMask          = 255.255.255.0   ;{Any IP Address: x.x.x.x, as
per RFC 1878}
DeviceDefaultGateway      = 192.168.0.1     ;{Any IP Address: x.x.x.x}
SwitchPort1Speed          = 1G              ;{100M, 1G}
SwitchPort1Duplex         = Full            ;{Auto, Half, Full}
SwitchPort1FlowControl    = Disabled        ;{Disabled, Enabled}
SwitchPort2Speed          = 1G              ;{100M, 1G}
SwitchPort2Mode           = Master          ;{Master, Slave}
SwitchPort3Speed          = 1G              ;{100M, 1G}
SwitchPort3Mode           = Master          ;{Master, Slave}
SwitchPort4Speed          = 1G              ;{100M, 1G}
SwitchPort4Mode           = Master          ;{Master, Slave}
```

Figure 18. Device Configuration File. Default Configuration Parameters

The *[Info]* configuration parameter group is automatically generated by the device for information purposes only. It contains read-only configuration parameters, is completely optional, and can be omitted if the file is prepared by the user.

The *[Controller]* configuration parameter group does not have any configuration parameters in this version of the firmware. It can be also omitted.

The *[Ethernet]* configuration parameter group contains all 13 updatable configuration parameters of the device. The user can change any of them.

For the user's convenience, the device automatically writes all allowed values of an updatable configuration parameter in comments beside that configuration parameter when a configuration file is generated.

For detailed information on the updatable configuration parameters, please refer to:

- Table 1. Network Configuration Parameters.
- Table 2. Ethernet Configuration Parameters for Port [1].
- Table 3. Automotive Ethernet Port Configuration Parameters.

There are no specific restrictions on the number of configuration parameters in a configuration file. The file can have all or just one configuration parameter provided that the configuration parameter group of the configuration parameter is also specified. This allows creation of a configuration file that changes only a specific set of configuration parameters without affecting all other settings.

For example, a configuration file that configures port #4 of the switch to the "Slave" mode at "100Mbps" is presented in Figure 19.

```
; Device Configuration File
; -------------------------
; This file will configure port #4 to Slave mode at 100 Mbps

[Ethernet]
SwitchPort4Speed          = 100M           ;{100M, 1G}
SwitchPort4Mode           = Slave          ;{Master, Slave}
```

Figure 19. Device Configuration File to Configure Port #5

3.5 *Password Update Web Page*

The device password can be changed on the *Password Update* web page by clicking on the *Password* link on the left side of the device web page, see Figure 20.

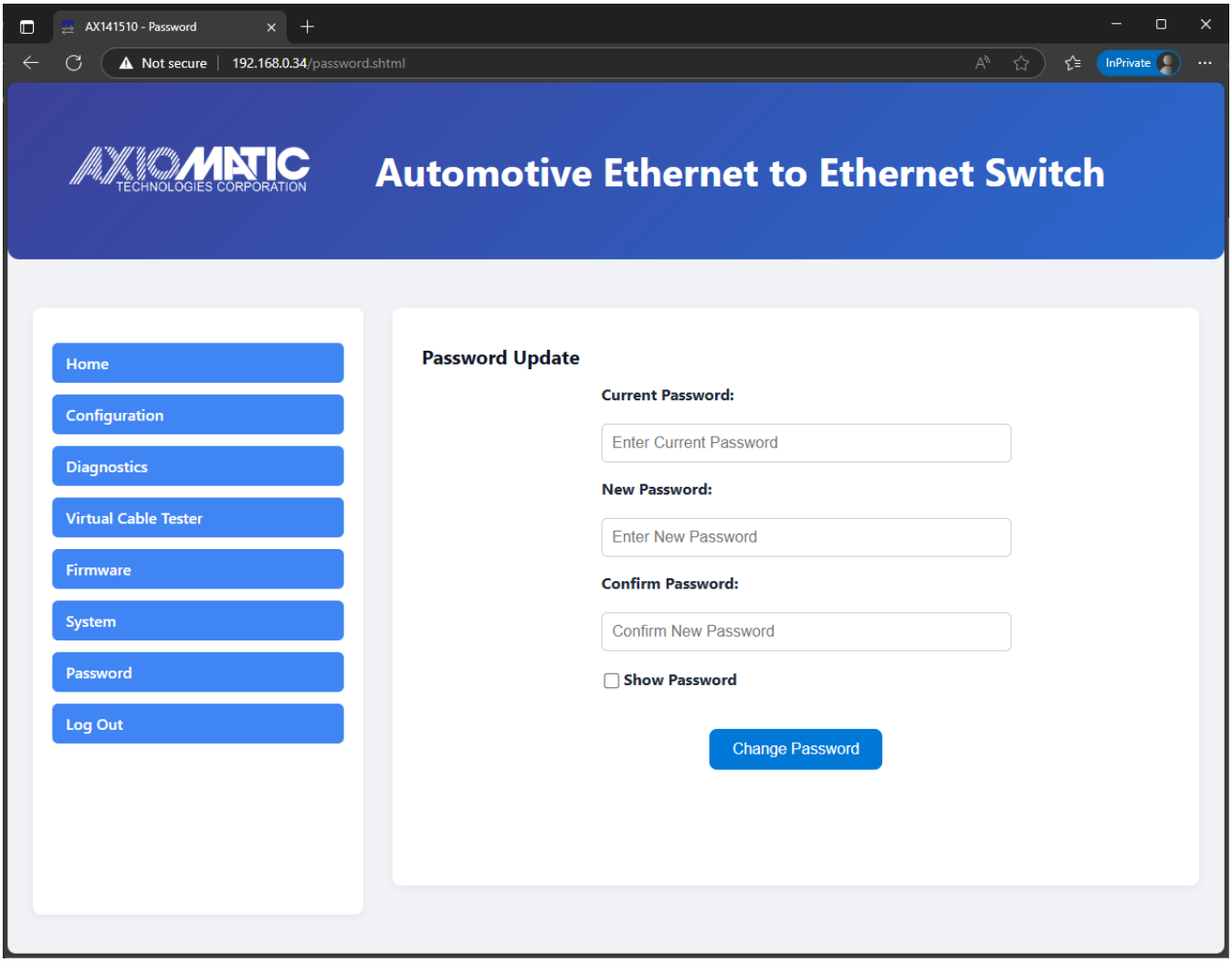


Figure 20. Password Update Web Page

To update the device password, the user should enter the current passwords and then enter and confirm the new password.

The password should contain at least one number, one uppercase and one lowercase English letter. Special characters are allowed except colon (:). Spaces are allowed in the middle of the password. The password length should be from 8 to 30 characters. The new password should be different from the old one. The user will be prompted to follow the password rules in case any of the password requirements are not met.

The user can see all entered passwords when the *Show Password* checkbox is selected.

The result of the password update operation will be shown to the user in an alert message from the device web site after pressing the *Change Password* button, see Figure 21.

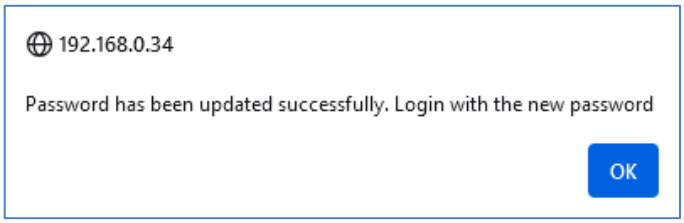


Figure 21. Password Update Alert Message

After the password has been changed successfully, the user will be automatically logged out and prompted to login again using the new password.

4 DEVICE DIAGNOSTICS

The user can see real-time diagnostic information on the *Diagnostics* web page of the device internal website.

To see the *Diagnostics* page, Figure 22, the user should click on the *Diagnostics* link on the left side of the web page.

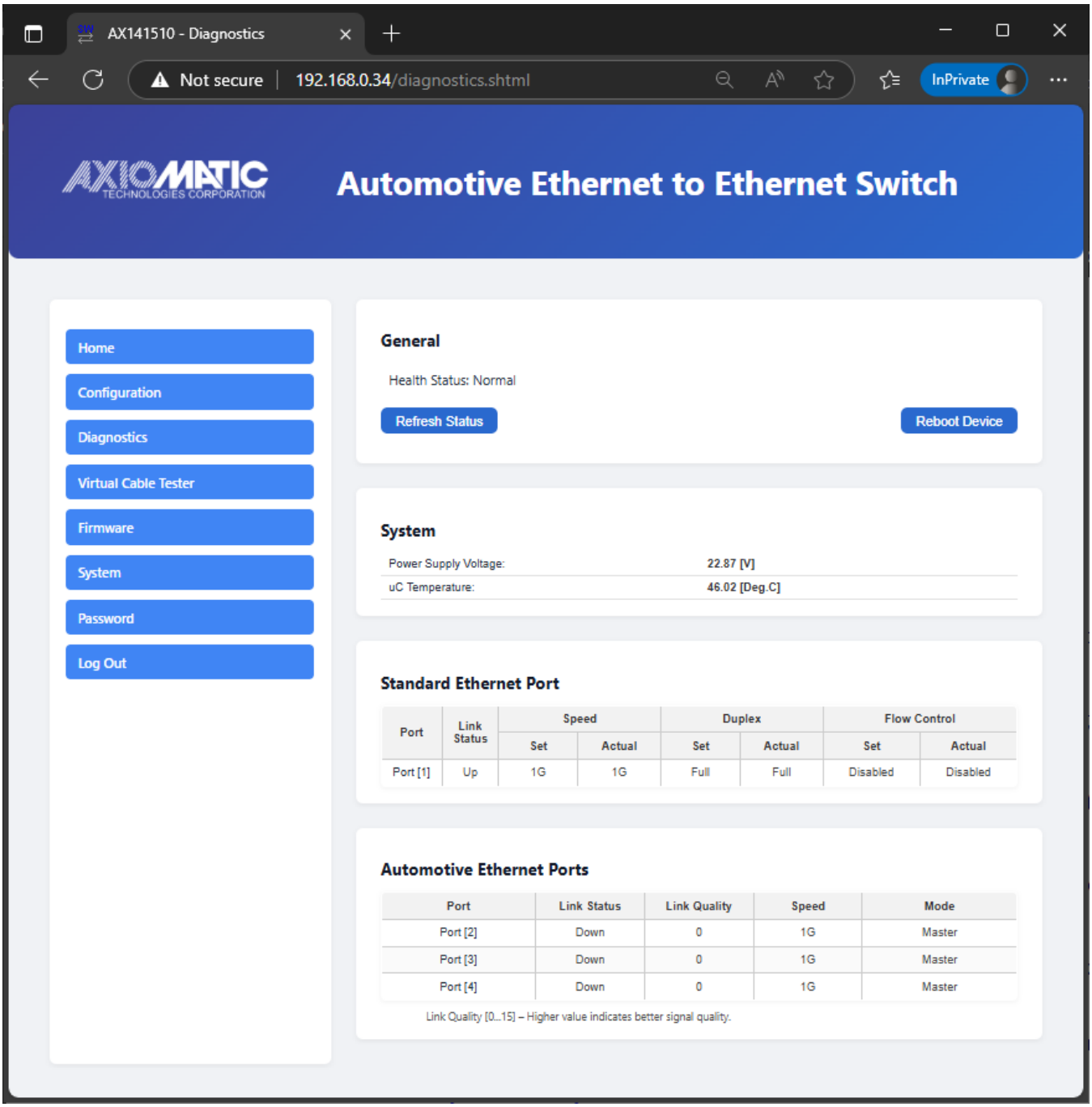


Figure 22. The Converter Diagnostics Web Page

The *Diagnostics* web page shows the *Health Status* of the device together with the *System* and *Automotive Ethernet Ports* status information.

The user can refresh the values on the page by pressing the *Refresh Status* button. The *Reboot Device* button activates the device rebooting.

The *Link Quality* automotive Ethernet port parameter is measured using Marvell 88Q211x Z1/A0/A1/A2 API and is intended to be used for information purposes only.

4.1 Health Status

The device *Health Status* is an aggregated system real-time parameter calculated on the base of individual operational statuses of the major device hardware and software components.

The *Health Status* presents the overall operational status of the switch, based on the following rules, see Table 5.

Table 5. Health Status

Health Status	Condition
Error	“Error” is reported when at least one operational status is in “Error” state.
Warning	“Warning” is reported when at least one operational status is in “Warning” state and there are no operational statuses in “Error” state.
Undefined	“Undefined” is reported when at least one operational status is in “Undefined” state and there are no operational statuses in “Error” or “Warning” state.
Normal	“Normal” is reported when all operational statuses are in “Normal” state.

4.2 Ethernet Ports

Each Ethernet port displays the *Link Status* of the port. It also shows the configured and the actual *Speed*, *Duplex* and *Flow Control* settings.

The actual *Speed*, *Duplex* and *Flow Control* settings are either the same as configured based on the forced *Speed* and *Duplex* settings or are acquired during the auto-negotiation between the link partners.

4.3 Automotive Ethernet Ports

Each automotive Ethernet port displays the *Link Status* of the port. For the ports participating in data communication (with *Link Status* “On”), the *Link Quality* metrics is shown on the scale of 0 to 15, where 0 is the lowest quality and 15 is the highest quality of the Ethernet connection.

4.4 Device Rebooting

The user can reboot the device, when necessary, using the *Reboot Device* button.

The switch rebooting operation takes 10 seconds. The user will see the *Reboot* screen with a countdown counter during this operation, see Figure 23.

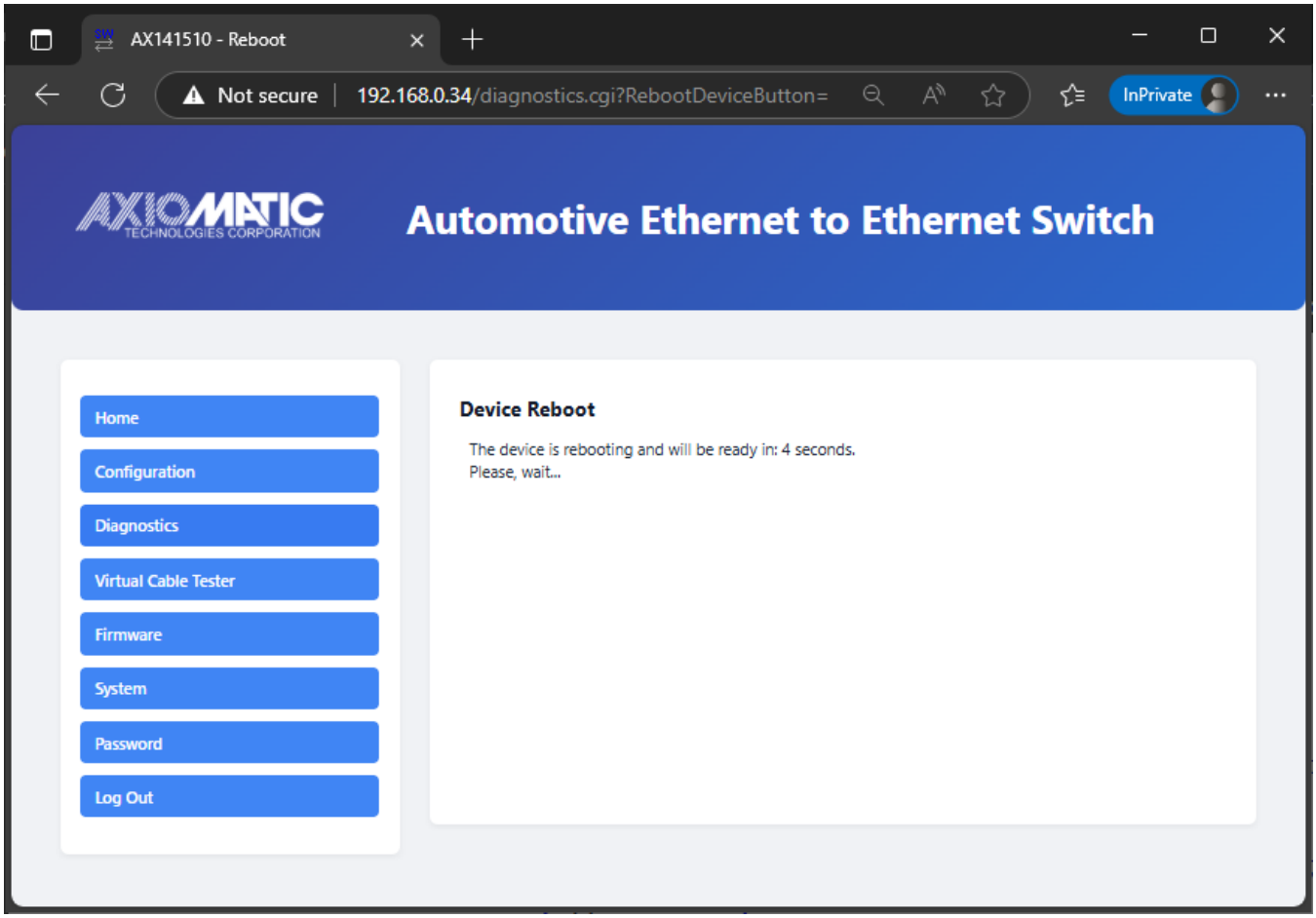


Figure 23. The Device Reboot Screen

When the rebooting operation is over, the device home page will be loaded.

5 VIRTUAL CABLE TESTER

The device has a virtual cable tester to check quality of the Ethernet switch cabling and to perform basic cable troubleshooting. It uses a time-domain reflectometry (TDR) test for testing cable integrity and a channel quality indicator (CQI) test to determine cable insertion and return losses in active Ethernet connections.

Both TDR and CQI tests are provided by Marvell 88Q211x Z1/A0/A1/A2 API. Their accuracy and consistency are not guaranteed by Axiomatic.

To access the virtual cable tester menu, Figure 24, the user should click on the *Virtual Cable Tester* link on the left side of the device web page.

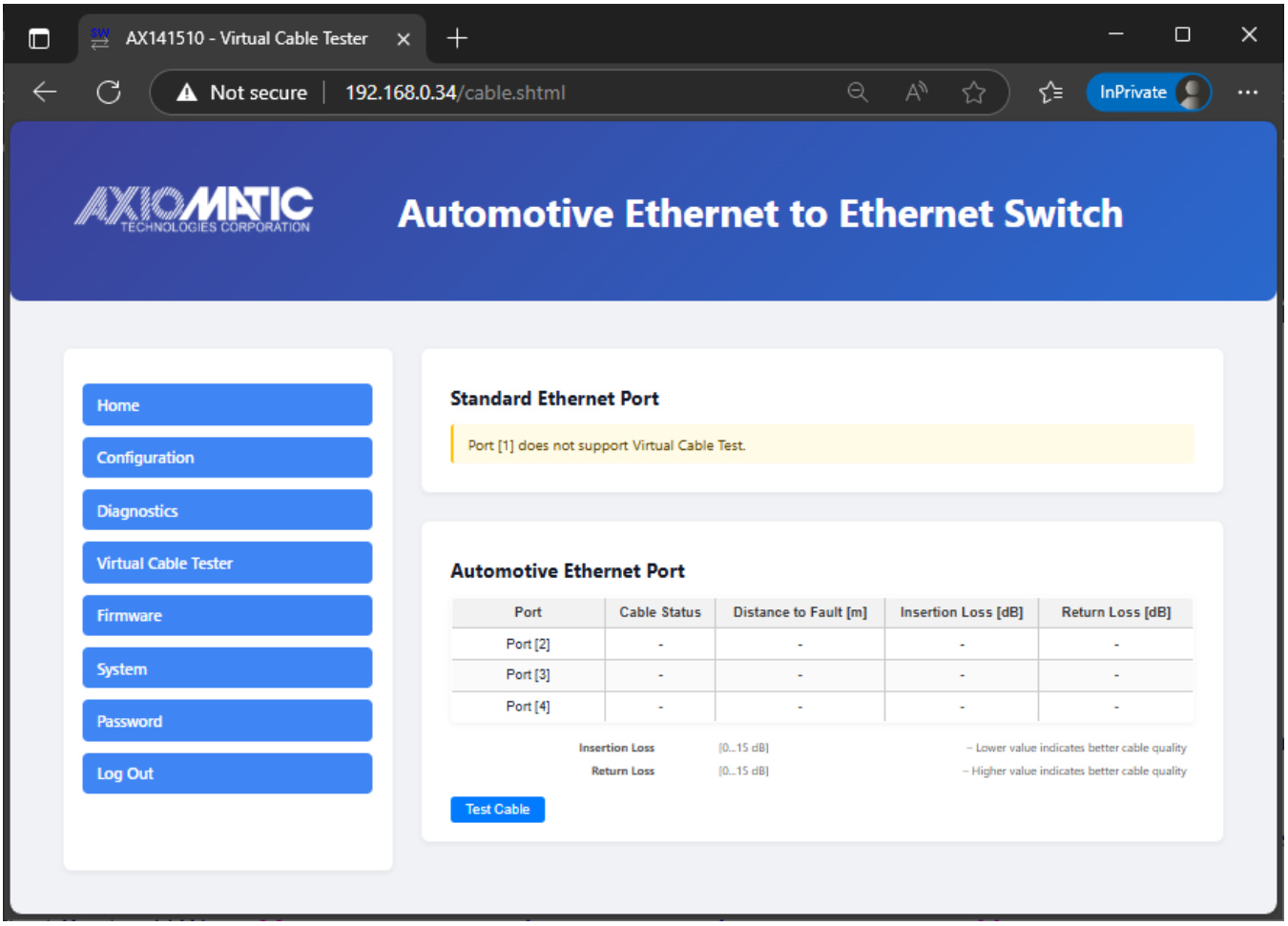


Figure 24. Virtual Cable Tester Web Page

The user activates cable testing by pressing the *Test Cable* button. The cable testing takes a couple of seconds during which the Ethernet communication will be disrupted. The results of the testing are displayed on the web page when the testing is completed, see Figure 25.

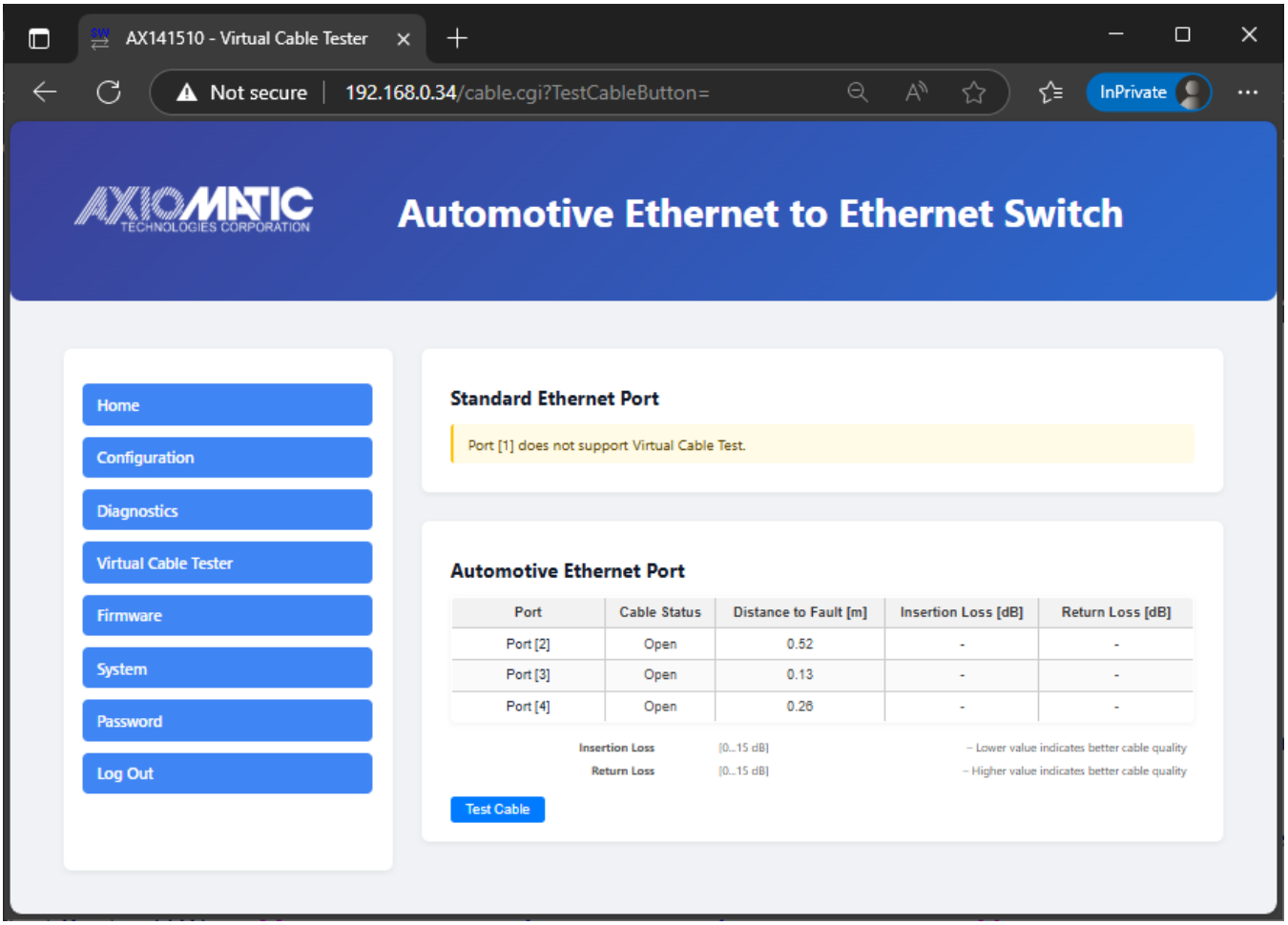


Figure 25. Virtual Cable Tester Test Results[1]

[1]Sign of the *Insertion Loss* and *Return Loss* was inverted in V3.00 to be in-line with TIA and ISO standards.

6 FIRMWARE UPDATE

The device application firmware can be updated through the device internal website.

The update procedure through the internal website is described below.

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

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

The device power should not be interrupted during firmware update to avoid possible corruption of nonvolatile memory.

6.1 Uploading New Firmware

To upload the new firmware, the user should activate the *Firmware Uploading* page, see Figure 26, by clicking on the *Firmware* link on the left side of the webpage[1].

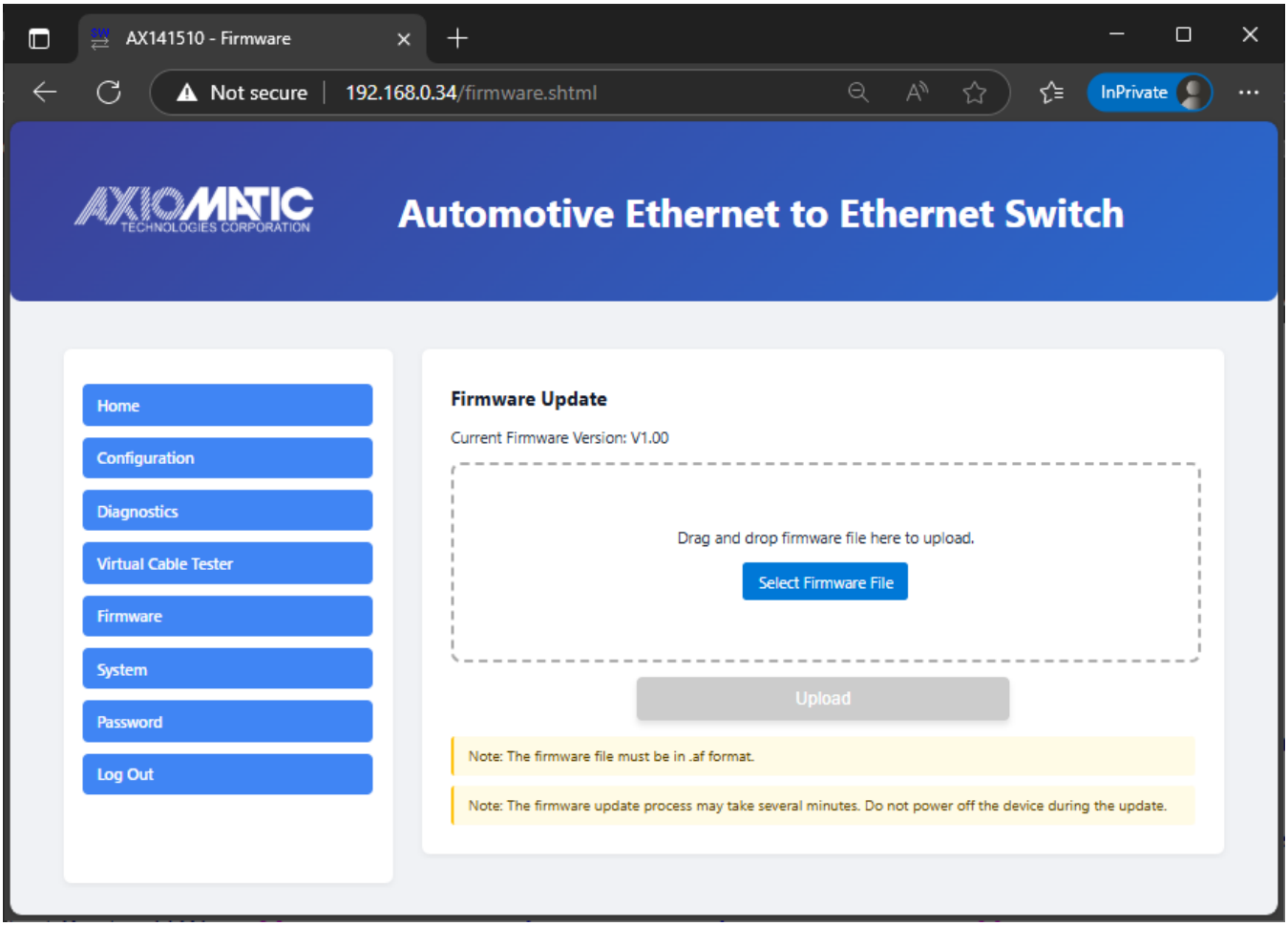


Figure 26. Firmware Uploading Page[1]

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

Then the user selects the new firmware file using the *Select Firmware File* button or just drag and drop the firmware file to the upload area.

The firmware file is provided by Axiomatic in a proprietary binary format with extension: `.af`. The file name should have the following format: `AF-24025-X.XX.af`, where the `<X.XX>` field wildcard reflects the firmware version number[1].

[1] `AF-24025-1.00.af` file will be used for illustration of the firmware update process in this manual.

When the file is selected, the user should press the *Upload* button. The user will see the loading spinner on the screen and then, if everything is in order, the converter will switch automatically to the *Firmware Update* page.

6.2 *Applying New Firmware*

On the *Firmware Update* page, the user will see the new firmware file information, see Figure 27.

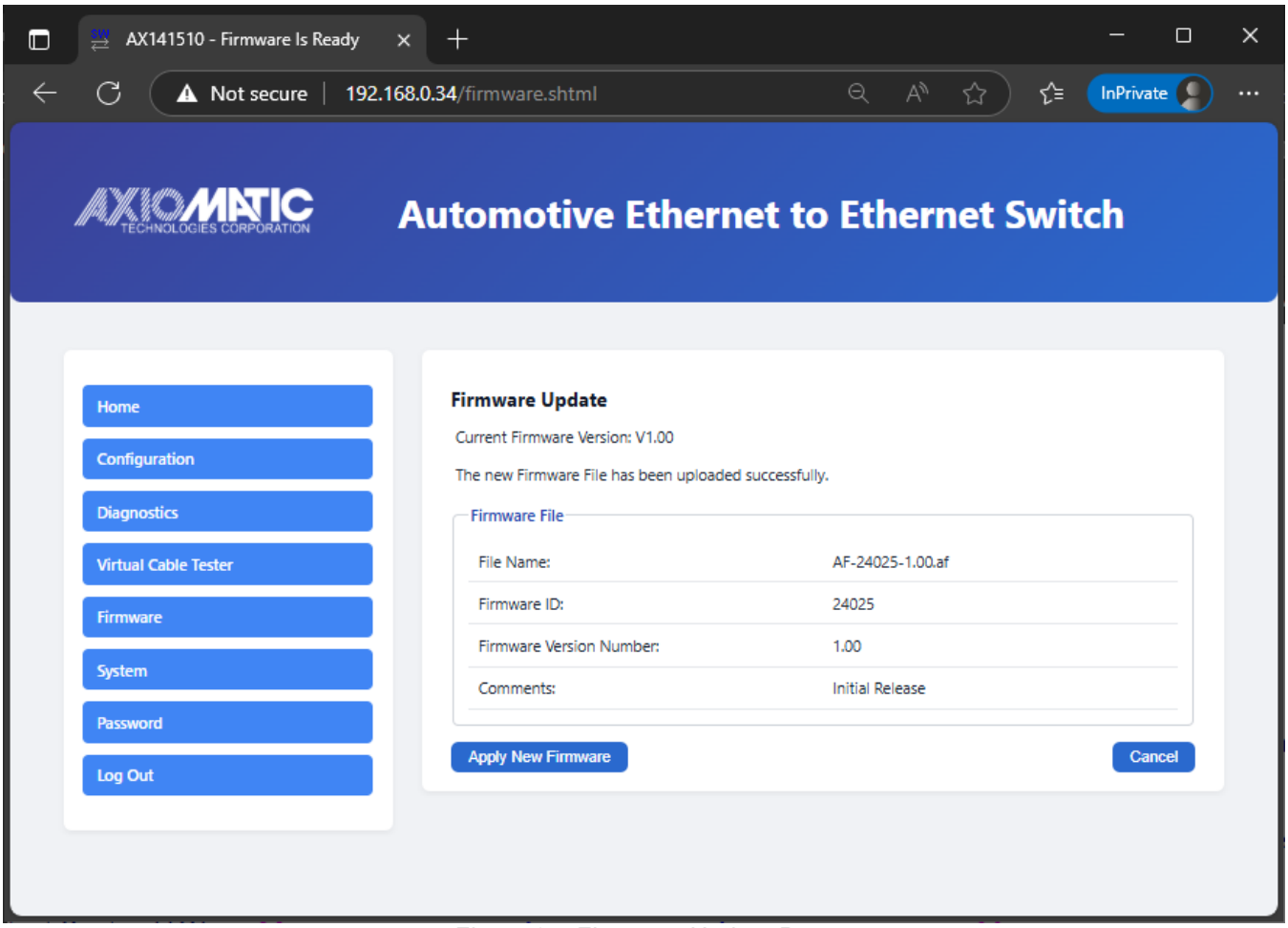


Figure 27. Firmware Update Page

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 a countdown timer, see Figure 28.

The countdown timer is set for 30 seconds necessary to complete the flashing process and reboot the device.

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 switch home page[1], see Figure 29.

[1]In our example, it is the same 1.00 version number since we used firmware version 1.00 to illustrate the firmware update process.

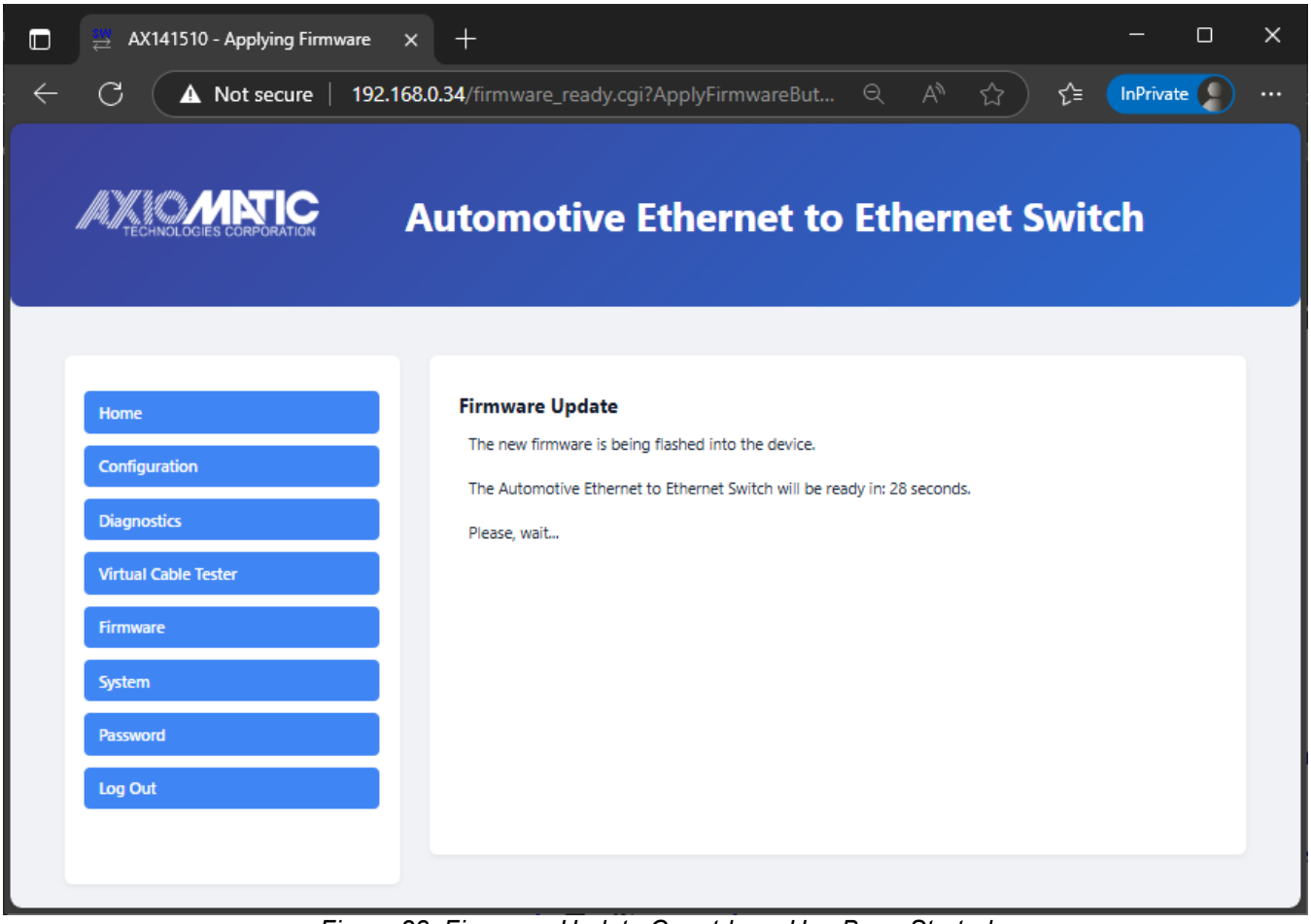


Figure 28. Firmware Update Countdown Has Been Started

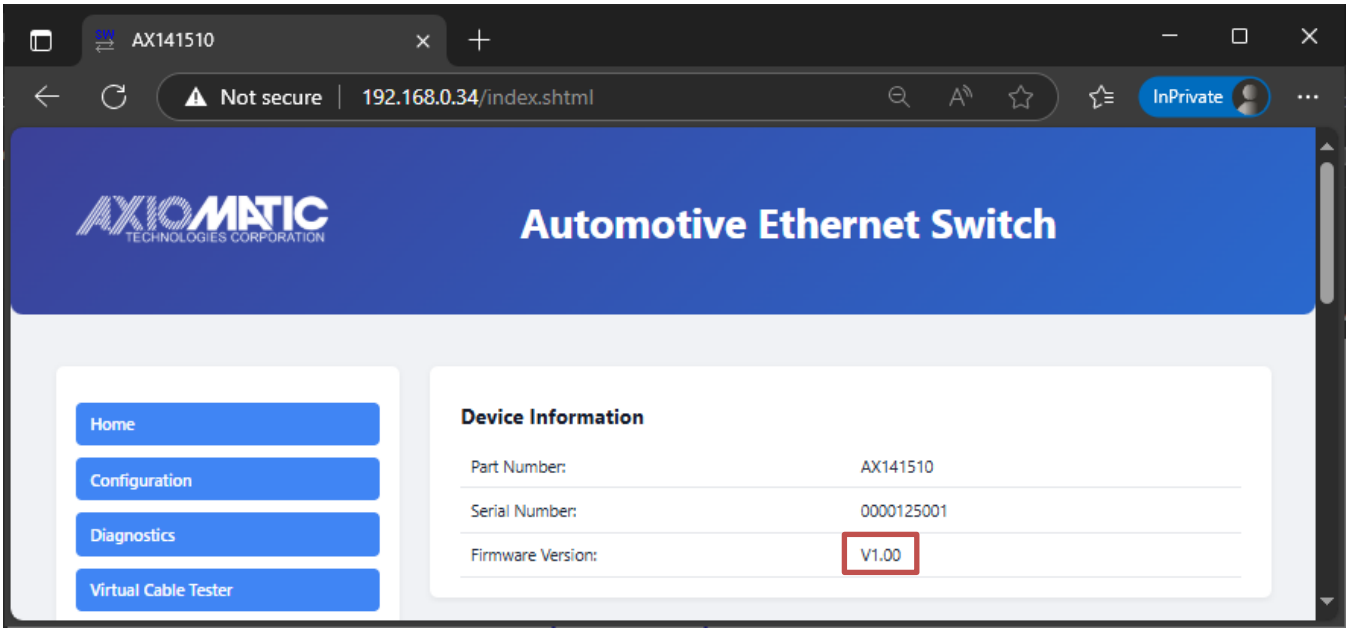


Figure 29. Firmware Version Number After Flashing

When the firmware is upgraded, all configuration parameters new to that version will take default values.

7 DEVICE DISCOVERY

In case the IP address of the device is unknown or has been lost, the user can recover it using the Axiomatic `AxioDisc.exe` Windows console application. The Ethernet interface on the device should be enabled.

7.1 Axiomatic Discovery Application

The `AxioDisc.exe` application uses a proprietary discovery protocol originally designed for Axiomatic converters. The application is available upon request.

The `AxioDisc.exe` application sends a UDP request to the broadcast IP address `255.255.255.255`, port `35100`, and waits for the responses from devices located on the same physical link of the LAN as the PC. The switch should be connected to the LAN through Port #1.

The device discovery response includes the unit *MAC Address*, *IP Address*, *Web Server Port*, the device *Part Number* and *Serial Number*, see Figure 30. It also includes parameters specific to Axiomatic converters that are not defined for the switch: *Device Port*, and *Device Port Type*. These parameters are set to {DevPort=0, DevPortType=UDP} and should be ignored.

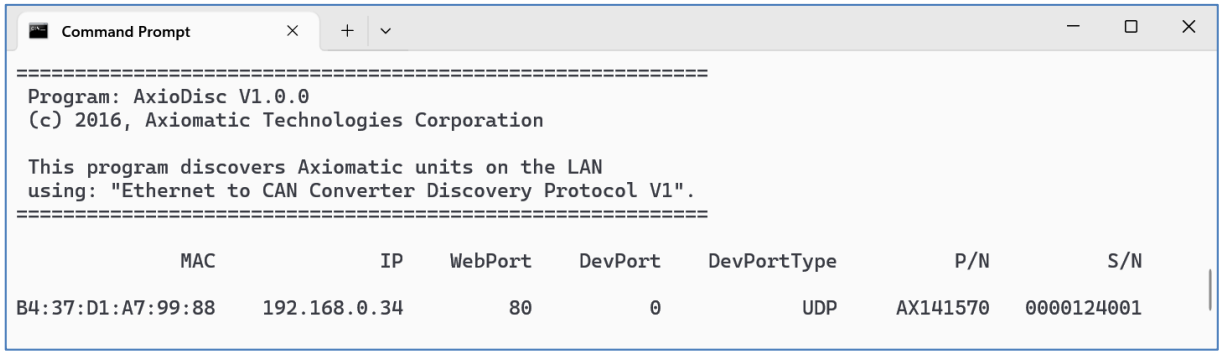


Figure 30. `AxioDisc.exe` Network Discovery Application

The `AxioDisc.exe` application can run on Windows starting from Win XP SP3. It was tested on Win XP SP3, Win 7, Win 10, and Win 11. In case the application cannot find standard dlls, the Visual C++ Redistributable for Visual Studio 2015 x86 must be installed on the user's computer from the Microsoft website: https://www.microsoft.com/en-ca/download/details.aspx?id=48145

The Axiomatic proprietary discovery protocol is supported by the CAN-ENET Software Support Package, P/N AX140910. The Software Support Package can be used by third party software developers to implement network discovery of the device.

8 TECHNICAL SPECIFICATIONS

Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Limitations & Return Materials Process as described on https://www.axiomatic.com/service/.

Power Input

Power Supply Input	12 VDC, 24 VDC nominal (9 VDC to 36 VDC power supply range)
Quiescent Current	225 mA @ 12 VDC; 117 mA @ 24 VDC
Protections	Surge protection is provided. Reverse polarity protection from 6 V to 36 V is provided. Undervoltage protection provided. Shuts down at 6.81 V and recovers at 7.43 V. Overvoltage protection provided. Shuts down at 59.58 V and recovers at 58.86 V.

Automotive Ethernet

Port	3 gigabit Automotive Ethernet / Single Pair Ethernet (SPE) ports 100 or 1000BASE-T1 (IEEE 802.3bp compliant) Automatic Polarity Correction (for 1000 Mbps mode) Note: For 100 Mbps mode, polarity correction is not functional. Default configuration: Master (Slave mode is configurable)
PHY	Marvell 88Q2112 (100BASE-T1 / 1000BASE-T1)
Protection	ESD protection for signal lines
Protocol	Automotive Ethernet IEEE 802.3bw for 100BASE-T1 (previously known as BroadR-Reach) Automotive Ethernet IEEE 802.3bp for 1000BASE-T1

Ethernet Port

Port	1 gigabit Ethernet port 10 or 100 or 1000BASE-T Auto-Negotiation Automatic Polarity Correction
MDIX	Auto-MDI/MDIX (crossover)
PHY	Marvell 88EA1512 (10BASE-T , 100BASE-TX, 1000BASE-T)
Protocol	Ethernet IEEE 802.3
Protection	ESD protection for signal lines

General Specifications

Microcontroller	STM32H725IGK3
User Interface	The unit runs a webserver and can be configured through the web interface.
LEDs	5 bi-colour (RED/GREEN) LEDs

LED	ON	BLINK	OFF
POWER	Power on	Bootloader mode	No power
SPE1 LINK/ACT	Link up	Activity	No link
ENET LINK/ACT	Link up	Activity	No link
SPE3 LINK/ACT	Link up	Activity	No link
SPE2 LINK/ACT	Link up	Activity	No link

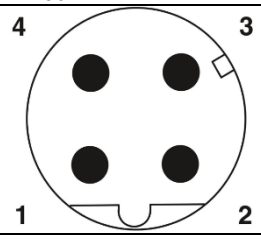
Compliance	RoHS
Operating Conditions	-40 to 65 °C (-40 to 149 °F)
Storage Temperature	-40 to 85 °C (-40 to 185 °F)
Protection	IP67
Vibration and Shock	Pending
Weight	0.25 lb. (0.113 kg)
Installation	The typical maximum wire harness length for Automotive Ethernet cabling is 15 m.
Enclosure and Dimensions	Injection molded enclosure and cover. Laser welded. PA66, 30% glass fiber reinforced 4.21 in. x 3.06 in. x 1.60 in. (106.8 mm x 77.7 mm x 40.6 mm) L x W x H including connectors. Refer to Figure 31. Flammability Rating: UL 94 HB

Electrical Connections

Electrical Connections

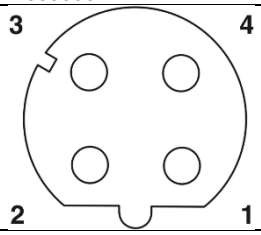
Power + Automotive Ethernet Connector
1x M12 4-pin connector (D-coded), male, Phoenix Contact P/N: **1441862**

Pin	Description
1	TRD +
2	Power -
3	TRD -
4	Power +



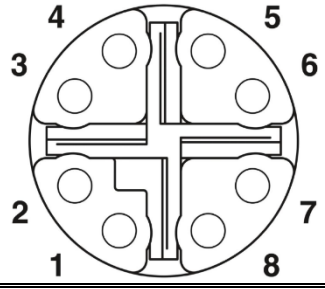
Automotive Ethernet Connectors
2x M12 4-pin connector (D-coded), female, Phoenix Contact P/N: **1553006**

Pin	Description
1	TRD +
2	Do not connect
3	TRD -
4	Do not connect



Ethernet Connector
1x M12 8-pin connector (X-coded), female, Phoenix Contact P/N: **1237405**

Pin #	Description
1	DA +
2	DA -
3	DB +
4	DB -
5	DD +
6	DD -
7	DC -
8	DC +



Mating Connectors

Mating connectors should meet the following standard for M12 Connectors, IEC 61076-2-101:2012. The mating connectors should have the same coding.

Mating Cables

The following mating cables are available from Axiomatic.

1x Cable 2.0 m (6.5 ft.), 8-pin M12 X-coded, RJ45 Plug: **AX070521**

1x Automotive Ethernet and Power Cable, 2.0 m (6.5 ft.), 4-Pin M12 D-Coded Connector, 22 AWG Unterminated Leads: **AX070528-R2**

2x Cable 2.0 m (6.5 ft.) 4-Pin M12 D-Coded Connector, Unterminated Leads: **AX070168**

Refer to Figure 32 to Figure 34.

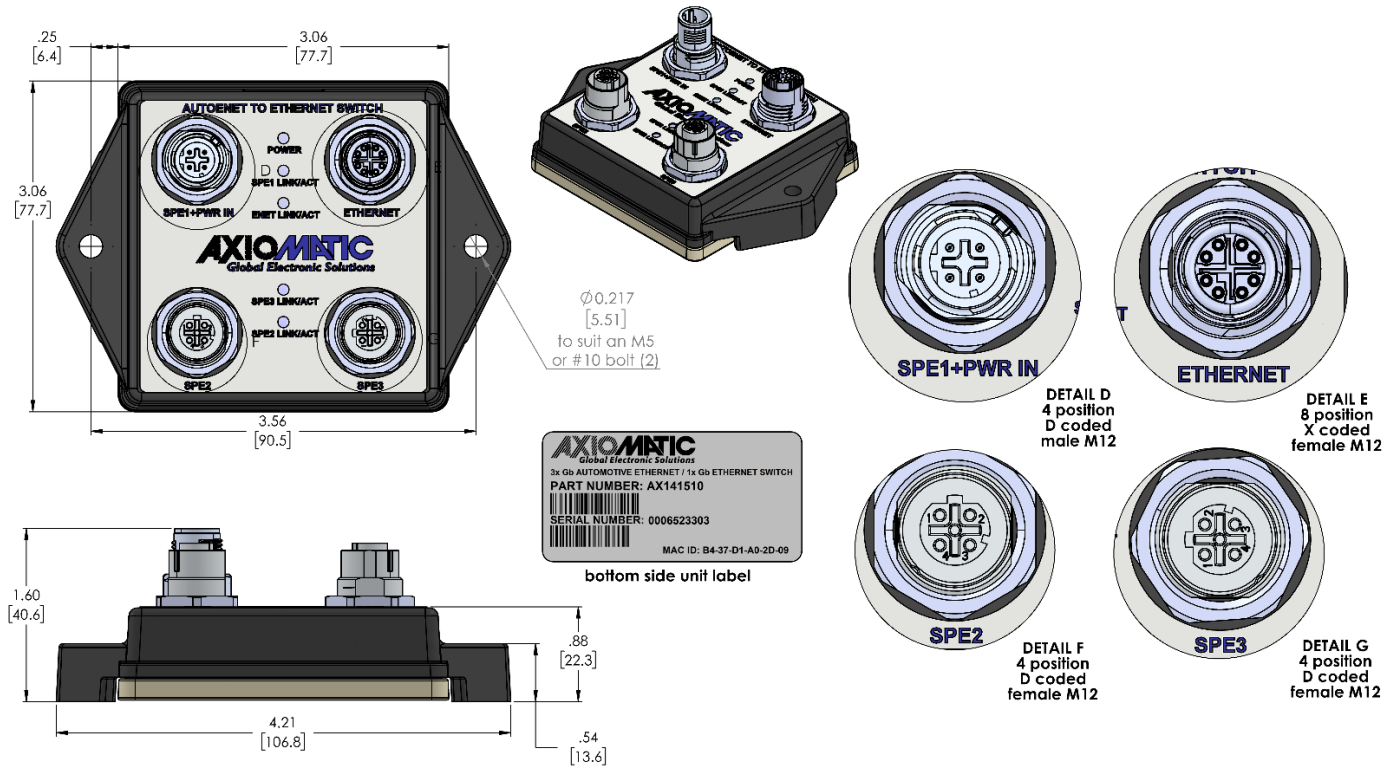


Figure 31. Dimensional Drawing AX141510

Network cable, Ethernet CAT6A (10 Gbps), CC-Link IE CAT6A (10 Gbps), 8-position, PUR halogen-free, water blue RAL 5021, shielded (Advanced Shielding Technology), Plug straight M12, coding: X / IP67, on Plug straight RJ45 / IP20, cable length: 2 m

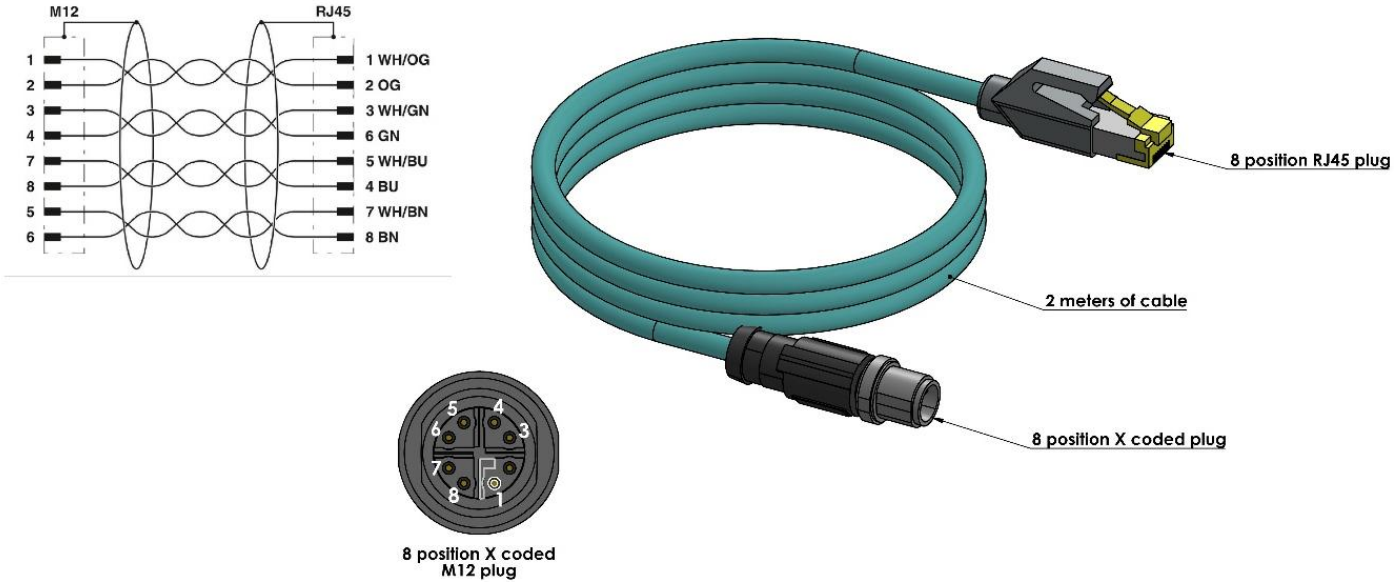


Figure 32. Mating Cable AX070521

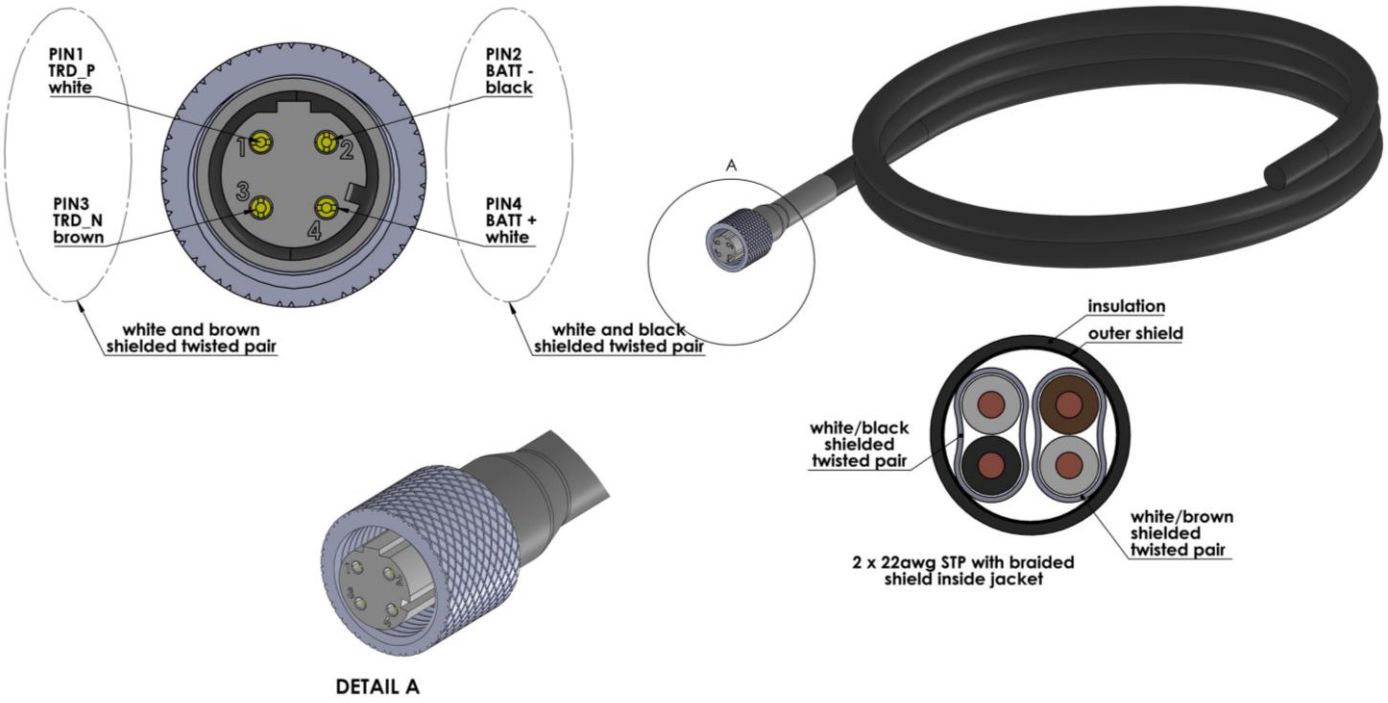


Figure 33. Mating Cable AX070528-R2

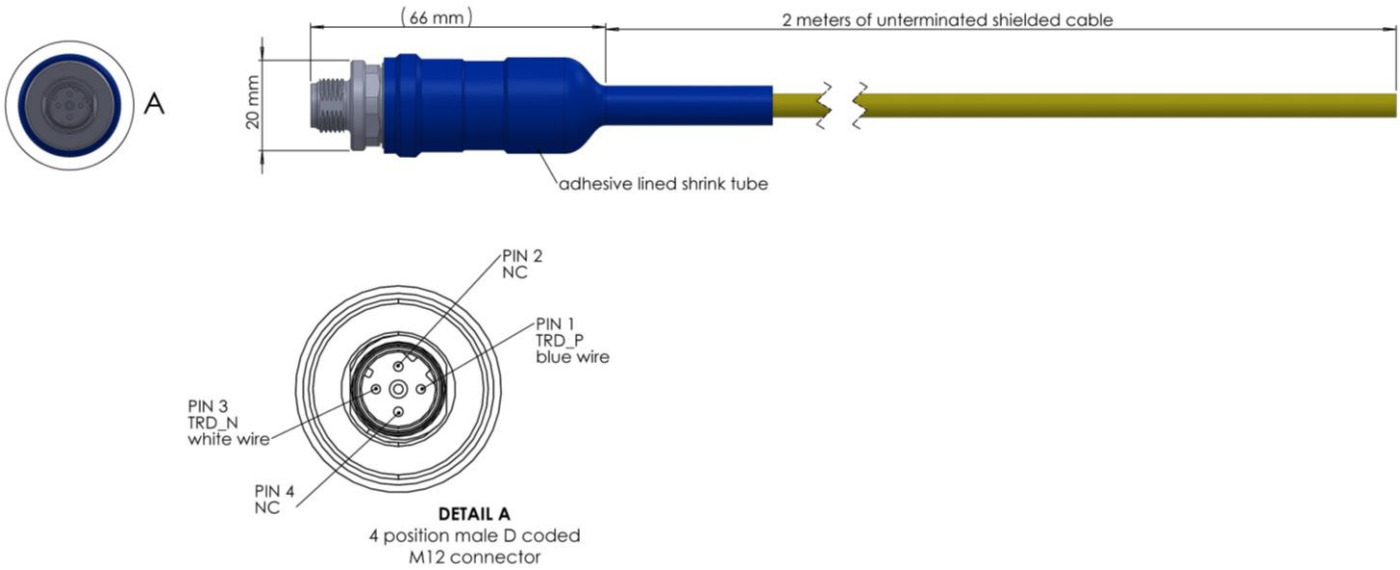


Figure 34. Mating Cable AX070168

9 THIRD PARTY SOFTWARE LICENSE NOTICES

This section contains Third Party Software License Notices and/or Additional Terms and Conditions for licensed third-party software components included in the switch firmware.

Table 6. Third Party Software License Notices

Third Party Software	License Notice/Terms
CMSIS v5.6.0	This software component is provided to you as part of a software package and applicable license terms are in the Package_license file. If you received this software component outside of a package or without applicable license terms, the terms of the Apache-2.0 license shall apply. You may obtain a copy of the Apache-2.0 at: https://opensource.org/licenses/Apache-2.0
STM32H7xx HAL Drivers V1.11.3	Copyright (c) 2017 STMicroelectronics. All rights reserved. This software component is provided to you as part of a software package and applicable license terms are in the Package_license file. If you received this software component outside of a package or without applicable license terms, the terms of the BSD-3-Clause license shall apply. You may obtain a copy of the BSD-3-Clause at: https://opensource.org/licenses/BSD-3-Clause
STM32CubeH7 V1.11.2	SLA0048 Rev4/March 2018 SOFTWARE PACKAGE LICENSE AGREEMENT BY INSTALLING COPYING, DOWNLOADING, ACCESSING OR OTHERWISE USING THIS SOFTWARE PACKAGE OR ANY PART THEREOF (AND THE RELATED DOCUMENTATION) FROM STMICROELECTRONICS INTERNATIONAL N.V, SWISS BRANCH AND/OR ITS AFFILIATED COMPANIES (STMICROELECTRONICS), THE RECIPIENT, ON BEHALF OF HIMSELF OR HERSELF, OR ON BEHALF OF ANY ENTITY BY WHICH SUCH RECIPIENT IS EMPLOYED AND/OR ENGAGED AGREES TO BE BOUND BY THIS SOFTWARE PACKAGE LICENSE AGREEMENT. Under STMicroelectronics' intellectual property rights and subject to applicable licensing terms for any third-party software incorporated in this software package and applicable Open Source Terms (as defined here below), the redistribution, reproduction and use in source and binary forms of the software package or any part thereof, with or without modification, are permitted provided that the following conditions are met: 1. Redistribution of source code (modified or not) must retain any copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form, except as embedded into microcontroller or microprocessor device manufactured by or for STMicroelectronics or a software update for such device, must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

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88Q211x Z1/A0/A1/A2 API Version 1.24 (5/27/2021)	Copyright (C) 2021 Marvell International Ltd. All rights reserved. This file is subject to the limited use license agreement by and between Marvell and you, your employer or other entity on behalf of whom you act. In the absence of such license agreement the following file is subject to Marvell's standard Limited Use License Agreement.
UMSD Version 7.0.0	Copyright (c) 2022 Marvell. All rights reserved. Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. 3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission. THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THEIMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF

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10 VERSION HISTORY

User Manual Version	Firmware Version	Date	Author	Modifications
1.0.0	1.xx	May 23, 2025	Weixin Kong	Initial release.
1.0.1	1.xx	Jan. 5, 2026	Ejaz M	Reformatting Updated title Updated technical specifications Added accessory cable diagrams

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

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