User Manual UMAX141590
Version 1C
Firmware 1.xx

USER MANUAL

5-Port Gigabit Ethernet Switch

1 Port 10Gbit/s, 4 Ports Automotive 1Gbit/s

P/N: AX141590

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ACRONYMS

AF	Application Firmware
ARP	Address Resolution Protocol
AX	Axiomatic
BATT	Battery
bps	Bit per second
°C	Celsius (degree)
CAT	Category
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
MDIX	Medium Dependent Interface Crossover
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

RGB	Red, Green, Blue
RoHS	Restriction of Hazardous Substances
RS	Recommended Standard
RTOS	Real-Time Operating System
SP	Service Pack or Single Pair
SPE	Single Pair Ethernet
SSP	Software Support Package
STP	Shielded Twisted Pair
TBD	To be Determined
TCP	Transmission Control Protocol
TDR	Time-Domain Reflectometry
TR	Technical Report
TRD	Transmit/Receive Differential
UDP	User Datagram Protocol
UTP	Unshielded Twisted Pair
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 5-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 interface or through the RS-232 port.

2 DEVICE DESCRIPTION

The 5-Port Gigabit Ethernet Switch is designed for industrial and automotive applications requiring high performance 1Gbit/s Automotive Ethernet connectivity with ability to aggregate Ethernet traffic to one 10Gbit/s Ethernet port to prevent bandwidth loss.

The switch contains four 1Gbit/s Automotive Single Pair Ethernet (SPE) ports and one high-speed 10Gbit/s Ethernet port. All ports use industrial M12 connectors. The high-speed 10Gbit/s Ethernet port is intended for connection to the uplink Ethernet infrastructure or a high-bandwidth server but can be used as a regular downlink port.

Each switch port can be individually configured for the desired physical layer parameters, for example: connection speed, flow control, etc. The switch internal logic is not configurable, resulting in unmanaged switch functionality.

An embedded web server allows users to configure switch ports, monitor the device performance, download and upload configuration parameters, and update application firmware.

An auxiliary RS-232 port can be used as a local alternative to the remote web server interface, similar to a console port on a generic Ethernet switch.

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.

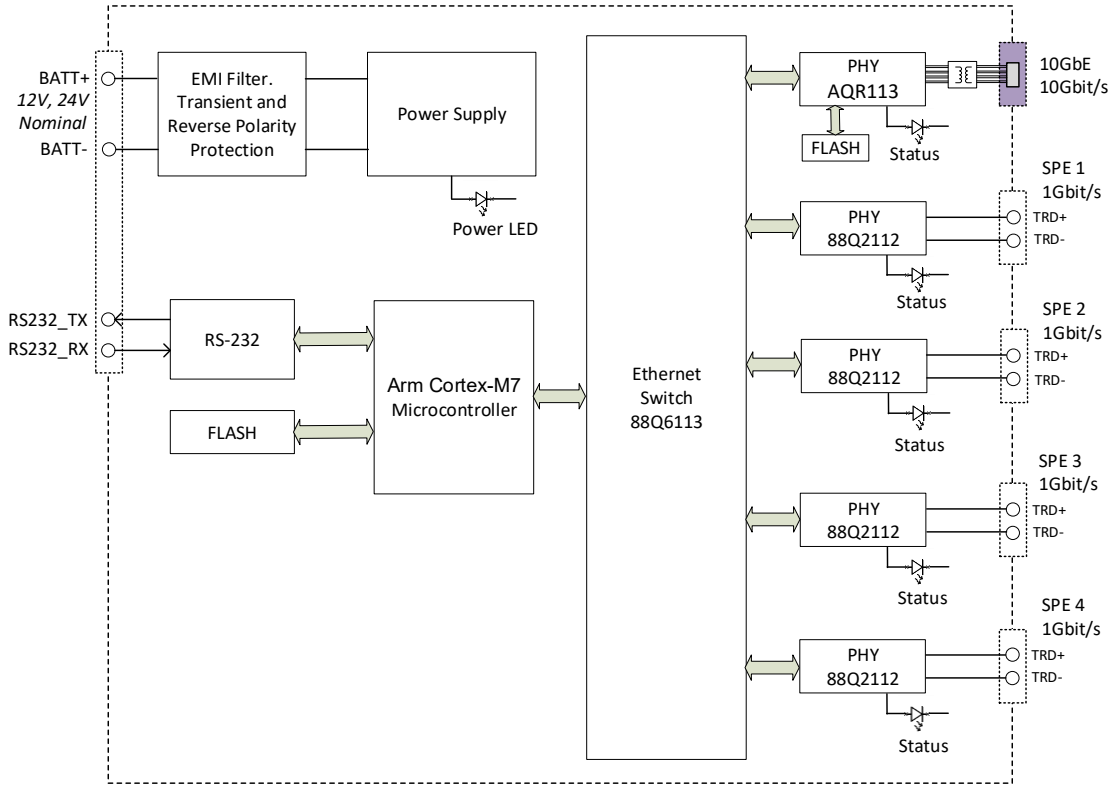


Figure 1. Device Hardware Block Diagram

The device contains five independent Ethernet ports: 10GbE, SPE 1…4, an auxiliary RS-232 port, and a protected power supply. 10GbE port supports up to 10 Gbit/s, and ports SPE 1…4 support up to 1 Gbit/s communication speed.

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 10Gbit/s PHY transceiver AQR113, and four Marvell 1Gbit/s automotive PHY transceivers 88Q2112. Each PHY transceiver has its own Status LED indicator hardwired to the PHY chip reflecting state, speed, and link activity on the port.

The 10Gbit/s PHY transceiver has its own flash memory holding the PHY firmware provided by Marvell.

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.

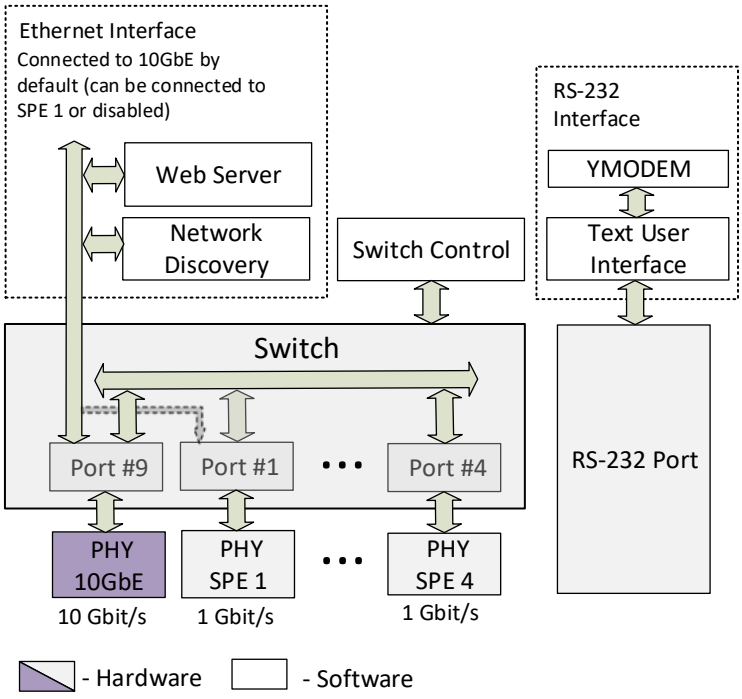


Figure 2. Device Internal Organization

The device software contains the *Switch Control* module and two user interfaces: *Ethernet Interface* and *RS-232 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 interface port, which is 10GbE port by

default. At the same time, the switch interface port can be used as a regular switch port without any restrictions.

The *Ethernet Interface* can be relocated from 10 GbE to SPE 1 port or completely disabled for security reasons. When the *Ethernet Interface* is disabled, the switch is invisible on the Ethernet.

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.

The user's web browser should support JavaScript.

For more information, see *Device Configuration*, *Device Diagnostics*, and *Firmware Update* sections of this document.

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.

2.2.2 RS-232 Interface

The *RS-232 Interface* serves as a local alternative to the embedded web server. It is presented by the *Text User Interface* module accessible through an auxiliary RS-232 port located on the device *Power Connector*, see *Power Connector* subsection of this document.

For more information, see *RS-232 Interface* section of this document.

2.2.2.1 Text User Interface

The *Text User Interface* is a simple menu-based user interface that provides the same scope of configuration, monitor and control options as the device web server. In addition, the user can relocate or disable the *Ethernet Interface* by individually changing *Ethernet Interface Port* configuration parameter.

The *Text User Interface* uses the *YMODEM* module for configuration file operations.

2.2.2.2 YMODEM

The *YMODEM* module is used by the Text User Interface module for configuration file upload and download operations. It interacts with the user's PC YMODEM software providing transmission of the configuration file.

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 interface port (10 GbE port by default). The device web access is also password protected.

The switch interface port can be changed to SPE 1 port or disabled by uploading a configuration file with *Ethernet Interface Port* configuration parameter set to the desired value, or through the RS-232 interface, see *RS-232 Interface* section of this document.

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, 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.

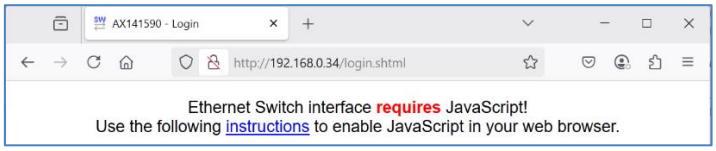


Figure 4. Enable JavaScript Prompt

The device 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.

In case the password is lost, the user can reset the password using RS-232 interface, see *Change Web Access Password* subsection of this document.

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 parameters and configuration of the Ethernet ports.

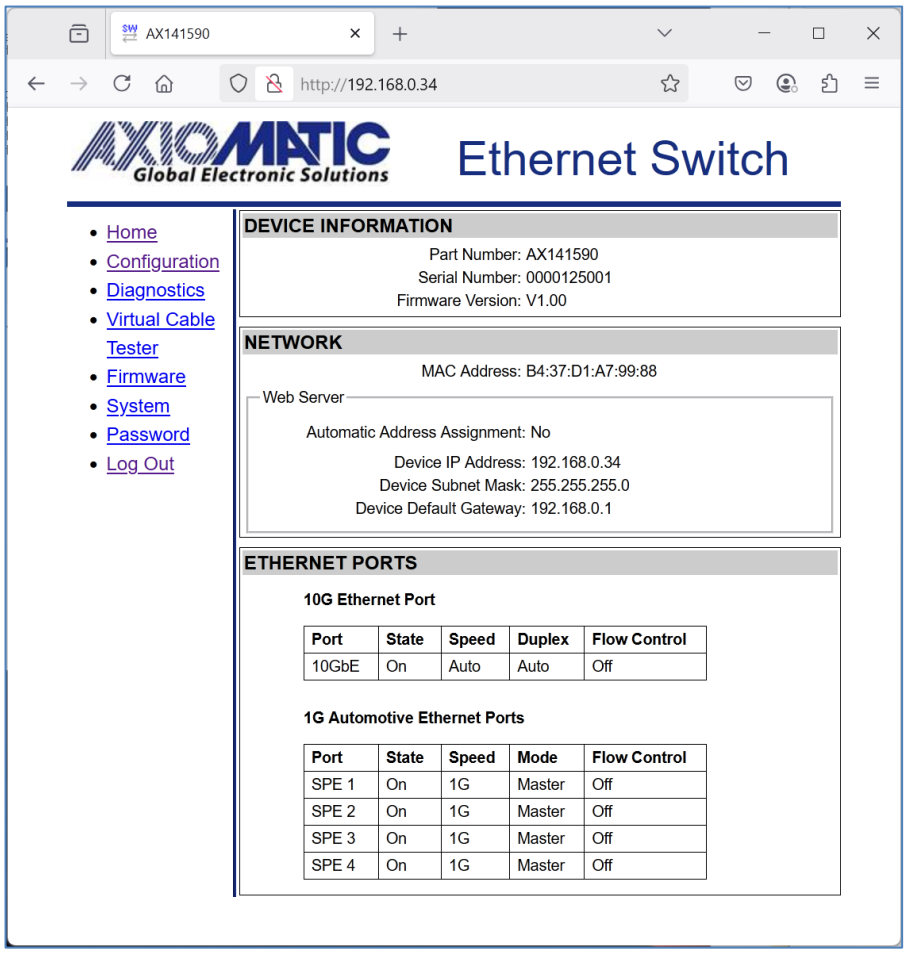


Figure 5. Device Home Page[1]

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

The *Network* and *Automotive Ethernet Ports* configuration parameters have tooltips clarifying their meaning, see Figure 6.

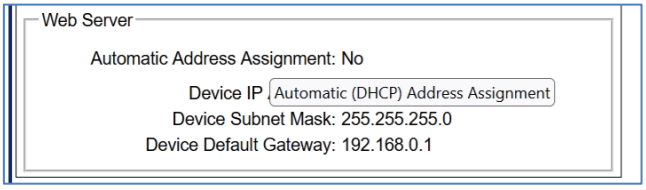


Figure 6. Tooltip for the "Auto Connect to Remote" Configuration Parameter

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 7.

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.

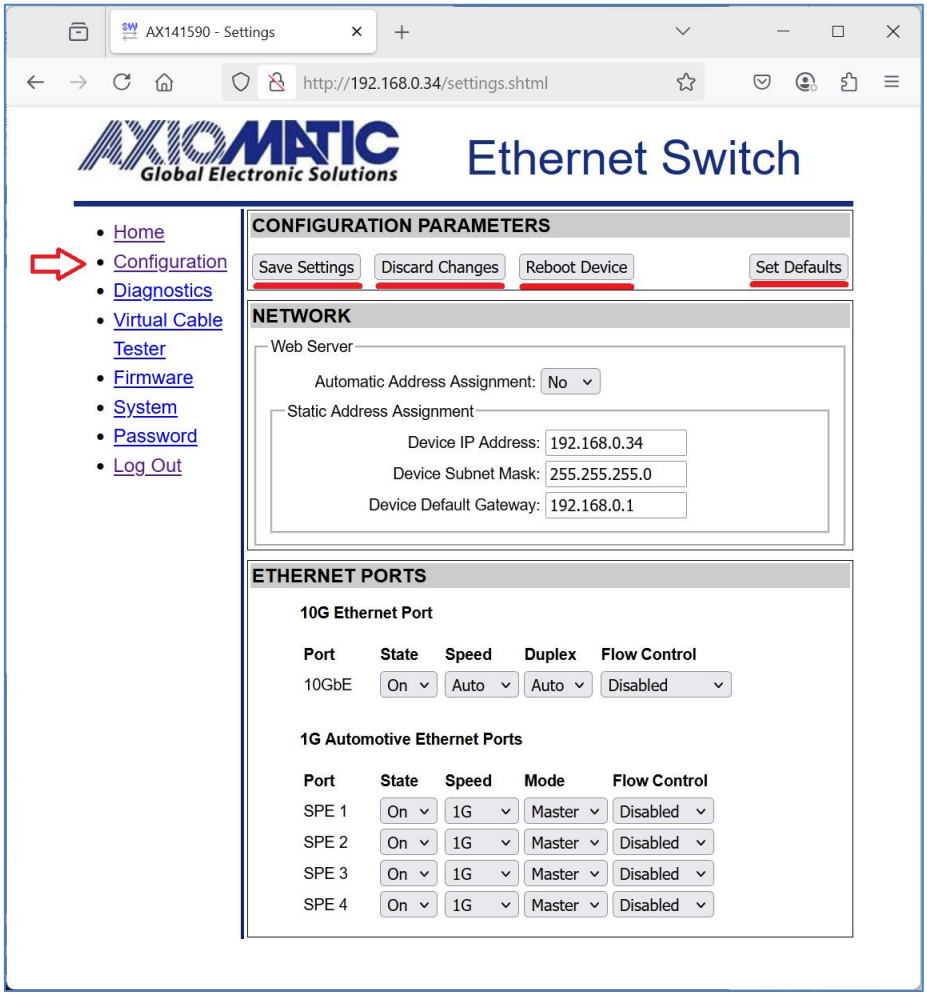


Figure 7. Configuration Web Page

The *Save Settings* button will save configuration parameters in nonvolatile 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 8.

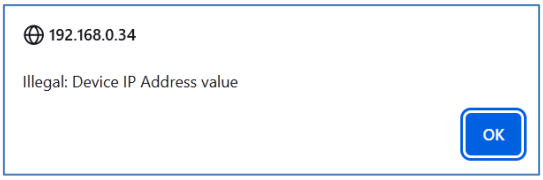


Figure 8. Settings Configuration Parameter Alert Message. Error in Configuration Parameter

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 9.

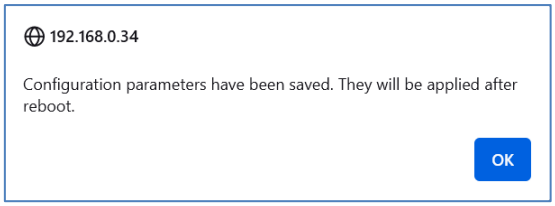


Figure 9. Settings Configuration Parameter Alert Message. Configuration Parameters have been Changed Successfully

3.3.2 Network Configuration

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

Table 1. Network Configuration Parameters

Configuration Parameter	Default Value	Range	Description
Ethernet Interface Port	Port_10GbE	{Disabled, Port_10GbE, Port_SPE1}	Ethernet interface port for configuring the switch. No Ethernet interface when “Disabled”. Not accessible through the configuration web page[4]
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 the 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. Use 1…223 (except 127) for the first (rightmost) address octet. Address 0.0.0.0 can be used to disable the device default gateway. *Device Default Gateway* should not be equal to *Device IP Address*.
[3]Use subnet mask IP addresses with all leading 1’s followed by trailing 0’s in the binary presentation as per RFC 1878.
[4]Can be updated through the configuration file or by using the RS-232 interface where it can be changed individually in interactive mode.

The web server uses a standard port number 80.

3.3.3 Ethernet Port Configuration

The user can individually change configuration parameters of each Ethernet port, see Table 2 and Table 4.

The Ethernet port should be enabled if it is used for configuring the switch. For example, if *Ethernet Interface Port* is equal to “Port_10GbE”, *State* of the 10GbE port should be “On”.

3.3.3.1 10GbE Port

Ethernet configuration parameters for 10GbE port are presented in Table 2.

Table 2. Ethernet Configuration Parameters for 10GbE port.

Configuration Parameter	Default Value	Range	Description
State	On	{Off, On}	Enables or disables the port[1]
Speed	Auto	{Auto, 10M, 100M, 1G, 2.5G, 5G, 10G}	Port communication speed
Duplex	Auto	{Auto, Full}	Port duplex setting. Only full-duplex is supported
Flow Control	Disabled	{Disabled, RxD_TxD_AN, TxD_AN, RxD_AN, RxD_TxD, TxD, RxD}	Port flow control

[1] When the port *State* is “Off”, the port PHY is disabled and switched to a low-power mode.

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 the forced “Full” *Duplex* mode, the auto-negotiation will be disabled. This can cause duplex mismatch, see *Duplex Mismatch*, and impact the flow control resolution, see *Flow Control*.

3.3.3.1.1 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 will default to half-duplex mode if half-duplex is supported.[1]

[1]10 GbE port 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.

3.3.3.1.2 Flow Control

The 10 GbE port uses 802.3x full-duplex flow control based on transmission (TxD) and reception (RxD) of the PAUSE frames, see Table 3.

Table 3. 10 GbE Port Flow Control

Flow Control	Description
Disabled	TxD and RxD flow controls are disabled.
RxD_TxD_AN	TxD and RxD flow controls are originally enabled but can be disabled based on the auto-negotiation results.
TxD_AN	TxD flow control is originally enabled but can be disabled based on the auto-negotiation results.
RxD_TxD	TxD and RxD flow controls are always enabled.
TxD	TxD flow control is always enabled.
RxD	RxD flow control is always enabled.

3.3.3.2 SPE Ports

Ethernet configuration parameters for SPE 1…4 ports are presented in Table 4.

Table 4. Ethernet Configuration Parameters for SPE 1…4 ports.

Configuration Parameter	Default Value	Range	Description
State	On	{Off, On}	Enables or disables the port[1]
Speed	1G	{100M, 1G}	Port communication speed
Mode	Master	{Master, Slave}	Port negotiation role
Flow Control	Disabled	{Disabled, RxD_TxD, TxD, RxD}	Port flow control

[1]When the port *State* is “Off”, the port PHY is disabled and switched to a low-power mode.

The device uses forced (manually set) SPE configuration parameters. Since auto-negotiation is not used, *Flow Control* can take only forced values, see Table 5. All SPE ports support only full-duplex communication.

Table 5. Flow Control for SPE 1…4 Ports

Flow Control	Description
Disabled	TxD and RxD flow controls are disabled.

Flow Control	Description
RxD_TxD	TxD and RxD flow controls are always enabled.
TxD	TxD flow control is always enabled.
RxD	RxD flow control is always 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 10, accessible by clicking on the *System* link on the left side of the web page.

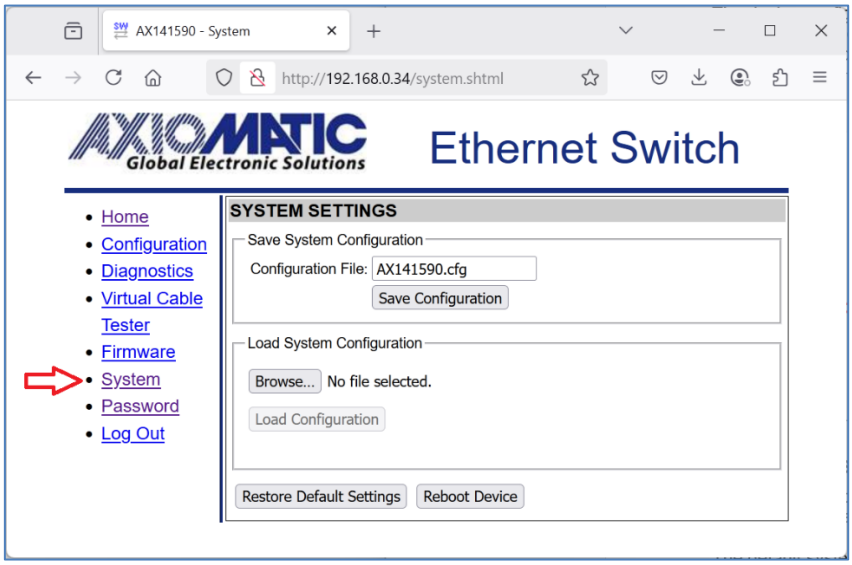


Figure 10. System Settings Web Page

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 “AX141590.cfg”. The configuration file will be generated and saved in the *Downloads* location of the web browser, see Figure 11.

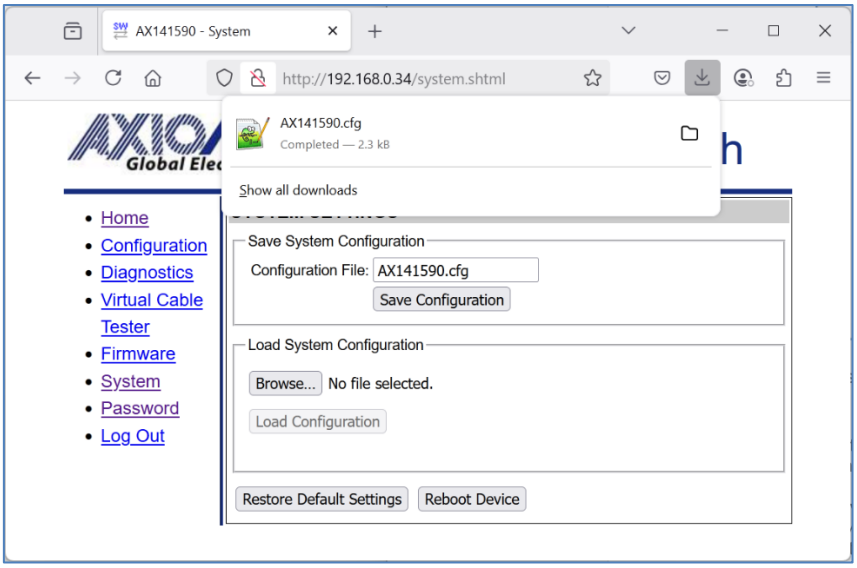


Figure 11. Saving System Configuration

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

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 *Browse…* button in the *Load System Configuration* group on the *System Settings* web page. 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 12.

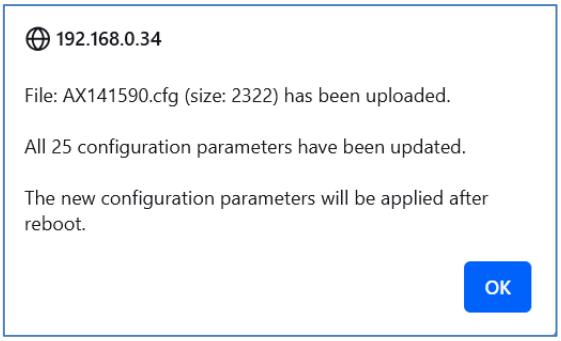


Figure 12. Loading System Configuration File Alert Message.
All Configuration Parameters Have Been Updated

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 *SwitchPortSPE2State* configuration parameter, when instead of *SwitchPortSPE2State* an incorrect *SwitchPortSPE2State** name is written, will result in the following error message, see Figure 13.

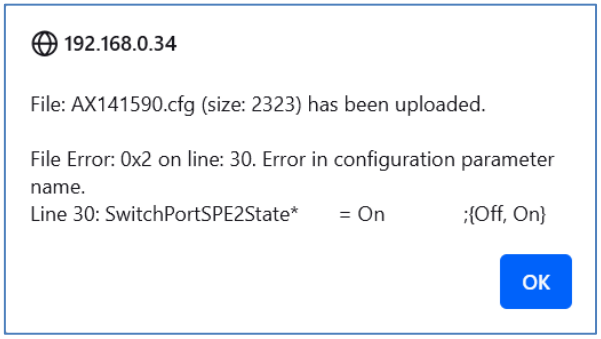


Figure 13. Loading System Configuration File Alert Message.
Error in Configuration File

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 *SwitchPortSPE2State* configuration parameter has an incorrect value of “On1” instead of “On”, the following error message will be generated, see Figure 14.

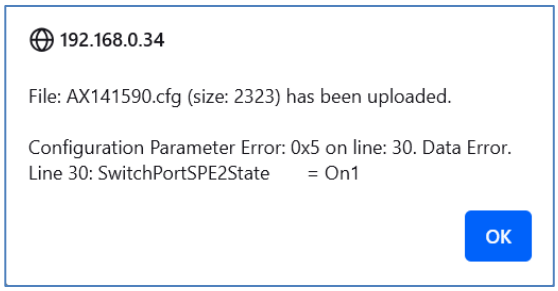


Figure 14. Loading System Configuration File Alert Message. Error in Configuration Parameter Value

After the configuration file has been parsed, the device checks integrity of the uploaded new configuration. Any errors will result in a data integrity error message. For example, if the *SwitchPort10GState* is set to “Off” when *EthInterfacePort* is equal to “Port_10GbE”, the following message will be generated, see Figure 15.

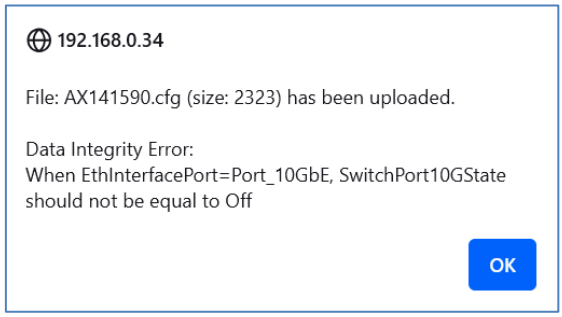


Figure 15. Loading System Configuration File Alert Message. Data Integrity Error

In case a configuration file has successfully updated, for example, only 24 configuration parameters out of the total 25 updatable device configuration parameters, the result message will show this information, see Figure 16.

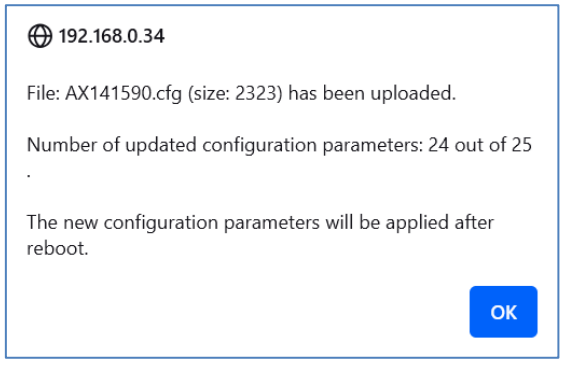


Figure 16. Loading System Configuration File Alert Message. Configuration Parameters Have Been Partially Updated

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 17.

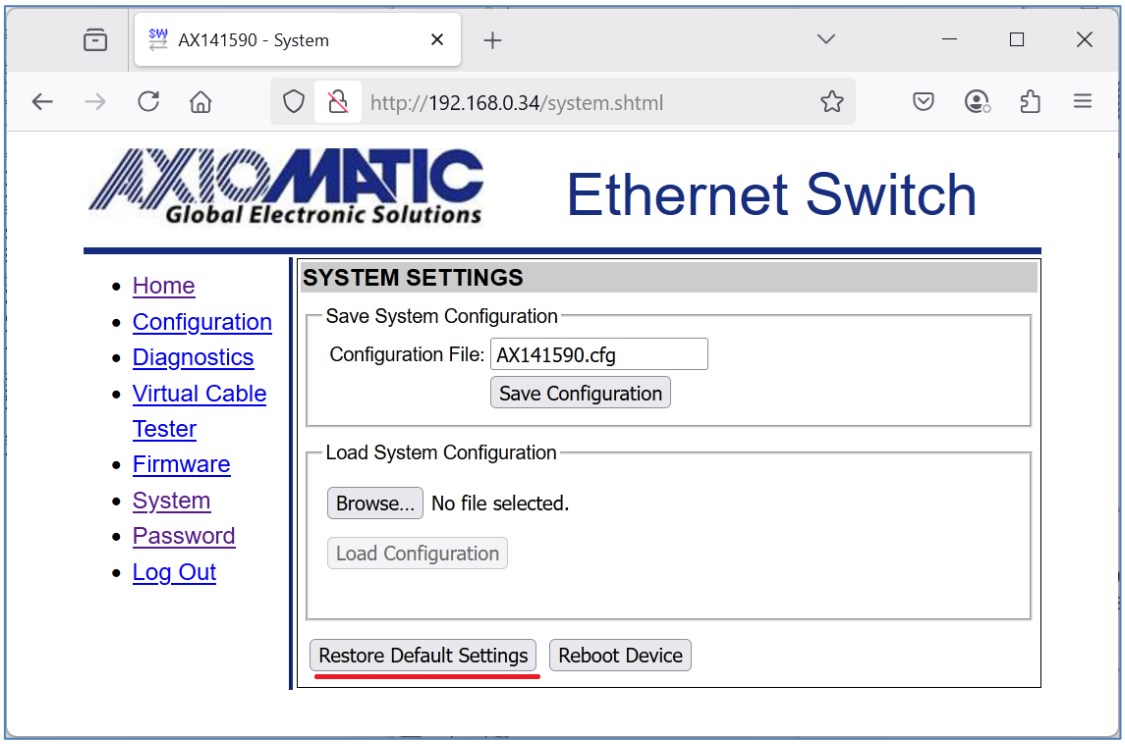


Figure 17. System Settings Page. Restore Default Settings

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 18.

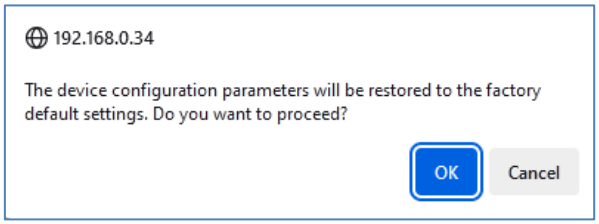


Figure 18. Restoring Default Settings Confirmation Alert Message

If the user chooses to proceed, the second alert message will inform the user of the result of this operation, see Figure 19.

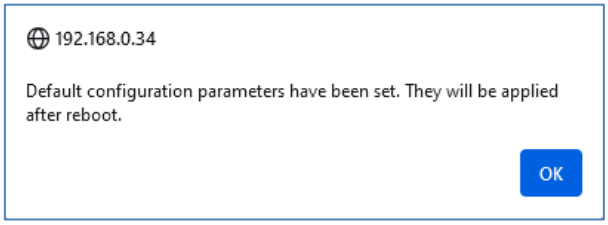


Figure 19. Restoring Default Setting Successful Result Alert Message

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 20.

```
; 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                = AX141590
SerialNumber              = 0000125001
MACAddr                   = B4:37:D1:A7:99:88
FirmwareID                = 24017
FirmwareVersionNumber     = 1.00

[Controller]

[Ethernet]
EthInterfacePort          = Port_10GbE      ;{Disabled, Port_10GbE, Port_SPE1}
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}
SwitchPort10GState        = On              ;If EthInterfacePort=Port_10GbE, then
{On}, else {Off, On}
SwitchPort10GSpeed        = Auto            ;{Auto, 10M, 100M, 1G, 2.5G, 5G, 10G}
SwitchPort10GDuplex       = Auto            ;{Auto, Full}
SwitchPort10GFlowControl  = Disabled        ;{Disabled, RxD_TxD_AN, TxD_AN,
RxD_TxD, TxD, RxD}
SwitchPortSPE1State       = On              ;If EthInterfacePort=Port_SPE1, then
{On}, else {Off, On}
SwitchPortSPE1Speed       = 1G              ;{Auto, 10M, 100M, 1G}
SwitchPortSPE1Mode        = Master          ;{Master, Slave}
SwitchPortSPE1FlowControl = Disabled        ;{Disabled, RxD_TxD, TxD, RxD}
SwitchPortSPE2State       = On              ;{Off, On}
SwitchPortSPE2Speed       = 1G              ;{Auto, 10M, 100M, 1G}
SwitchPortSPE2Mode        = Master          ;{Master, Slave}
SwitchPortSPE2FlowControl = Disabled        ;{Disabled, RxD_TxD, TxD, RxD}
SwitchPortSPE3State       = On              ;{Off, On}
SwitchPortSPE3Speed       = 1G              ;{Auto, 10M, 100M, 1G}
SwitchPortSPE3Mode        = Master          ;{Master, Slave}
SwitchPortSPE3FlowControl = Disabled        ;{Disabled, RxD_TxD, TxD, RxD}
SwitchPortSPE4State       = On              ;{Off, On}
SwitchPortSPE4Speed       = 1G              ;{Auto, 10M, 100M, 1G}
SwitchPortSPE4Mode        = Master          ;{Master, Slave}
SwitchPortSPE4FlowControl = Disabled        ;{Disabled, RxD_TxD, TxD, RxD}
```

Figure 20. 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 25 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 10GbE port..
- Table 4. Ethernet Configuration Parameters for SPE 1…4 ports..

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 disables SPE 4 port is presented in Figure 21.

```
; Device Configuration File
; -------------------------
; This file will disable SPE 4 port

[Ethernet]
SwitchPortSPE4State          = Off              ;{Off, On}
```

Figure 21. Device Configuration File to Disable SPE 4 Port

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 22.

Alternatively, the password can be changed through RS-232 interface, see ***Change Web Access Password*** subsection of this document.

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.[1] 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.

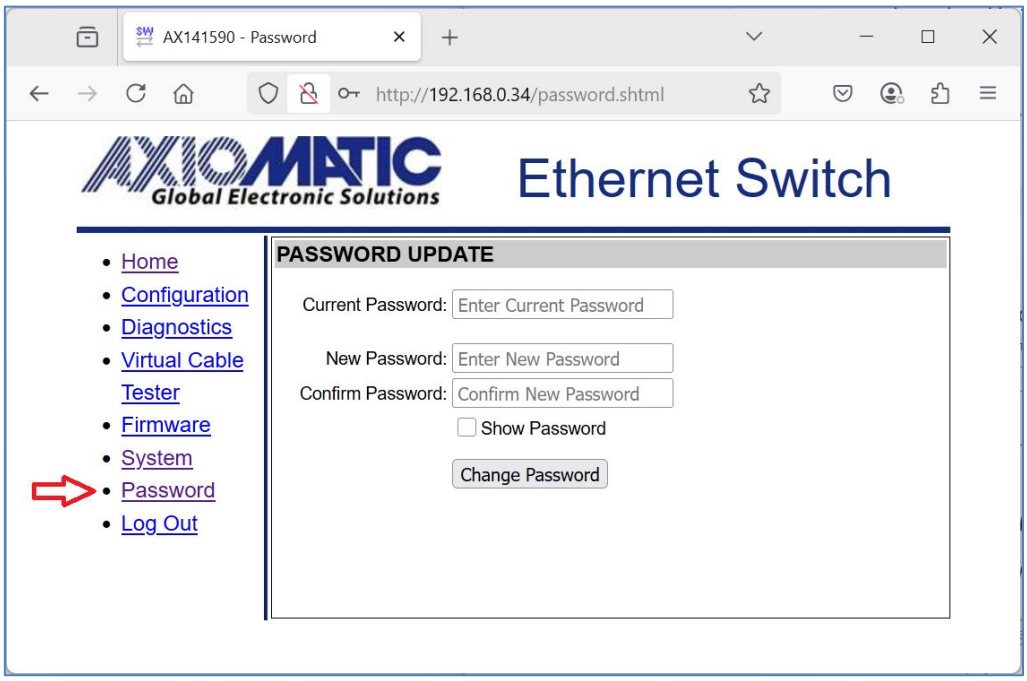


Figure 22. Password Update Web Page

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 23.

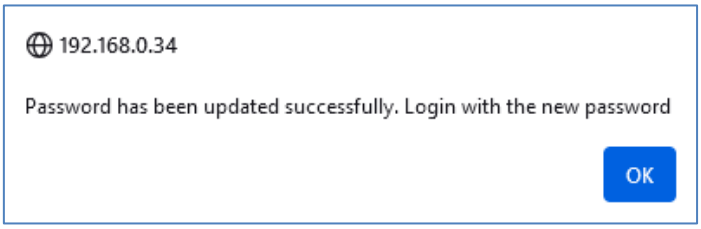


Figure 23. Password Update Alert Message

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 24, the user should click on the *Diagnostics* link on the left side of the web page.

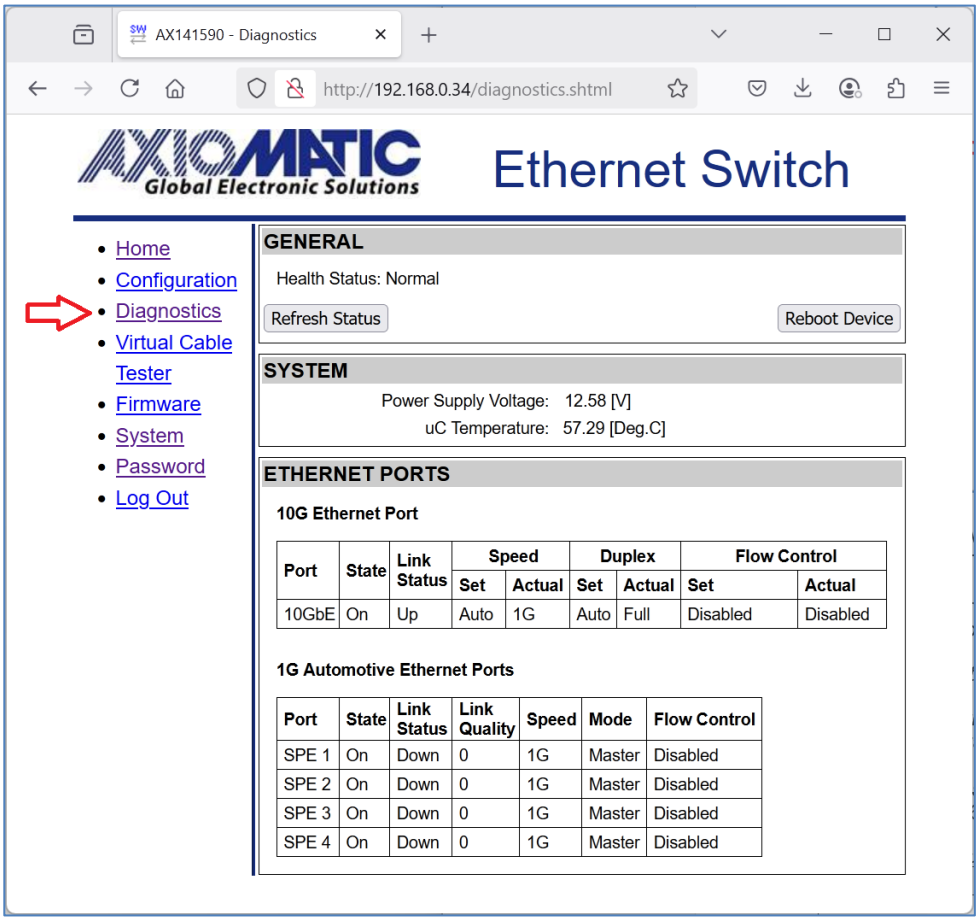


Figure 24. The Converter Diagnostics Web Page

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

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

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 6.

Table 6. Health Status

Health Status	Condition
Error	“Error” is reported when at least one operational status is in “Error” state.

Health Status	Condition
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.

If the *Health Status* is different from “Normal”, the user will see a verbose message on the *Diagnostics* web page below the *Health Status* describing which operational status is causing a problem.

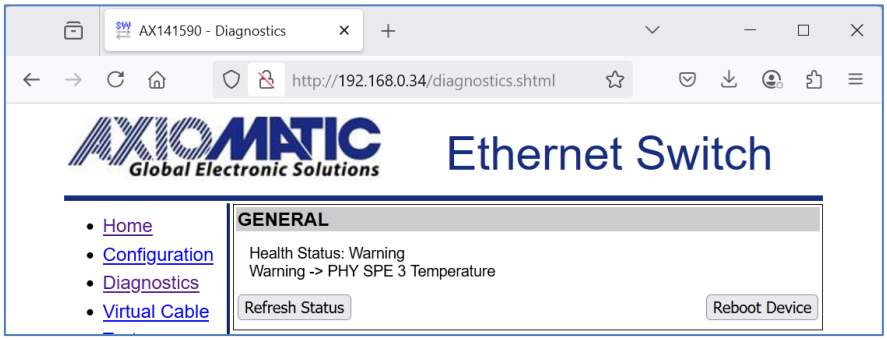


Figure 25. Health Status Message on PHY temperature error

In case several operational statuses differ from “Normal”, all of them will be shown on the *Diagnostics* page.

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 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 26.

Figure 26. 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 Ethernet cabling and to perform basic cable troubleshooting on automotive SPE ports. 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[1].

[1]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 27, the user should click on the *Virtual Cable Tester* link on the left side of the device web page.

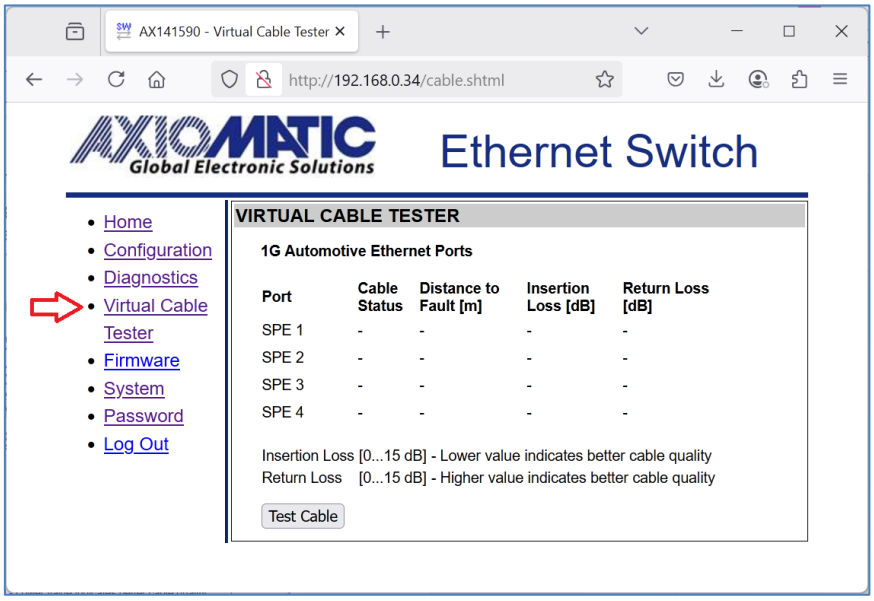


Figure 27. Virtual Cable Tester Web Page

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 28.

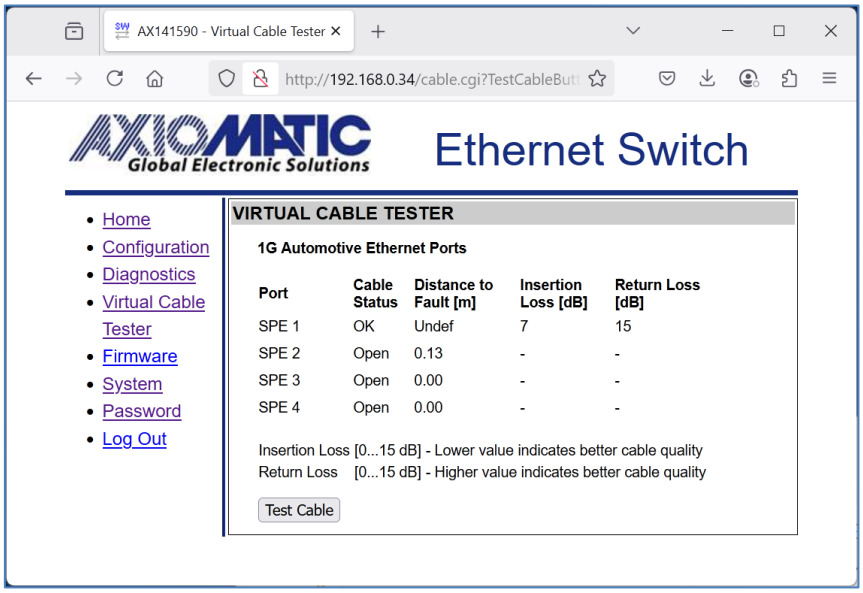


Figure 28. Virtual Cable Tester Test Results

6 FIRMWARE UPDATE

The device application firmware can be updated through the device internal website or the device auxiliary RS-232 port in the field.

The update procedure through the internal website is described below. The Ethernet interface on the device should not be disabled through the RS-232 port.

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 29, by clicking on the *Firmware* link on the left side of the webpage[1].

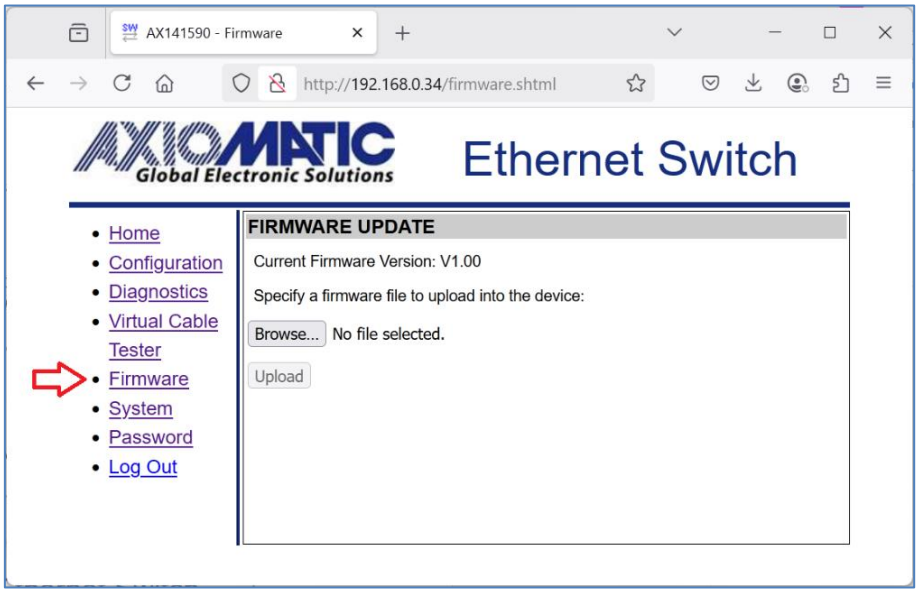


Figure 29. Firmware Uploading Page[1]

[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 *Browse…* 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-24017-X.XX.af`, where the `<X.XX>` field wildcard reflects the firmware version number[1].

[1]`AF-24017-1.00.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 dynamic message: “Loading…” in the bottom of 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 30.

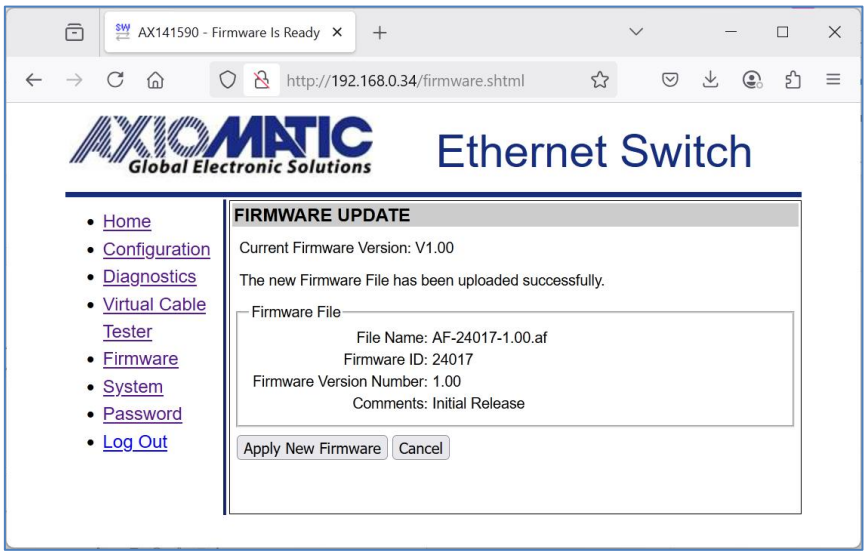


Figure 30. Firmware Update Page

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 31.

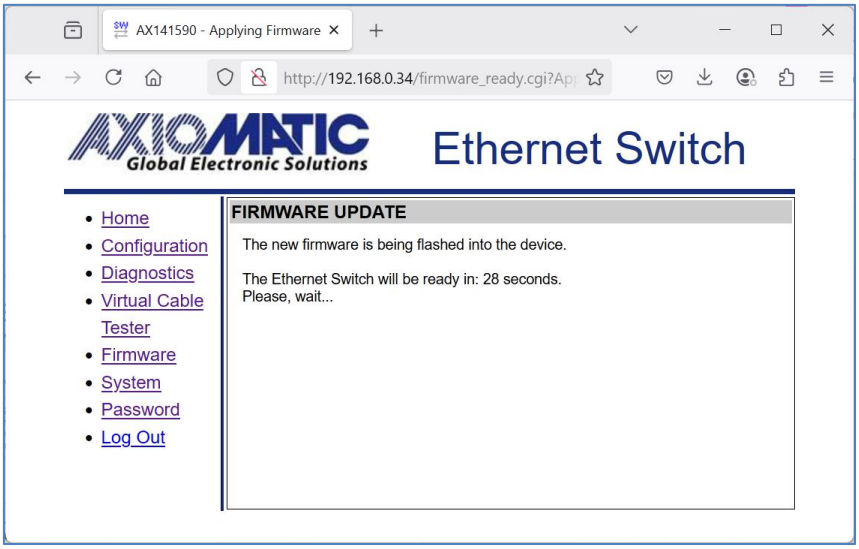


Figure 31. Firmware Update Countdown Has Been Started

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 32.

[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.

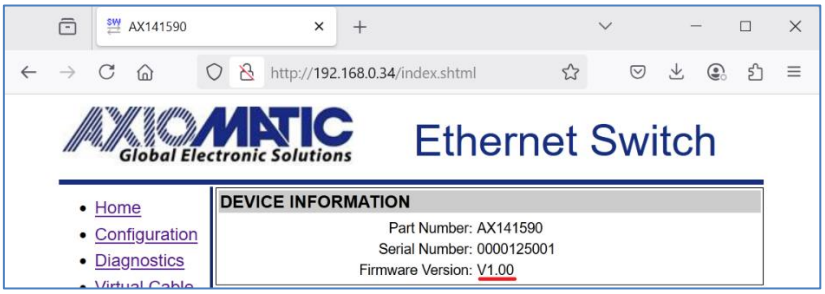


Figure 32. Firmware Version Number After Flashing

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 the Ethernet interface port (10 GbE port by default).

The device discovery response includes the unit *MAC Address*, *IP Address*, *Web Server Port*, the device *Part Number* and *Serial Number*, see Figure 33. 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.

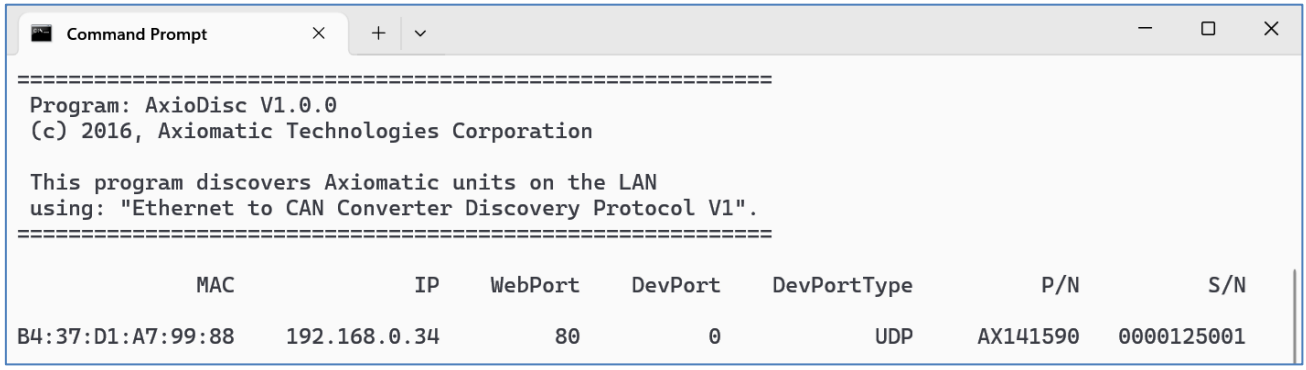


Figure 33. `AxioDisc.exe` Network Discovery Application

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 RS-232 INTERFACE

The RS-232 menu driven text user interface can be used as a local alternative to the device web interface for configuring, monitoring and controlling of the device.

The device power should not be interrupted during changing configuration parameters and flashing new firmware to avoid possible corruption of nonvolatile memory.

8.1 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 34.

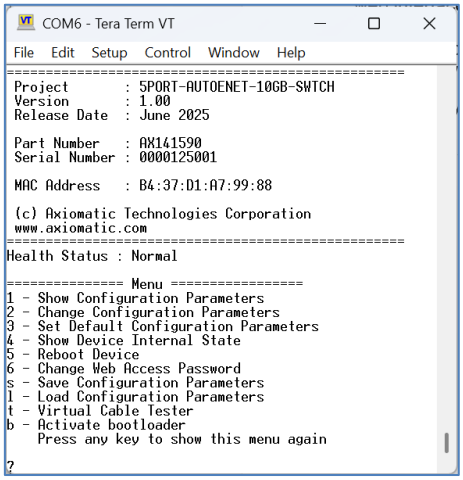


Figure 34. Main Text Menu[1]

[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. For example, to show configuration parameters of the device the user should press '1', to change web access password – '6', etc.

8.1.1 Show Configuration Parameters

When this option is activated, the user will see values of all configuration parameters, see Figure 35.

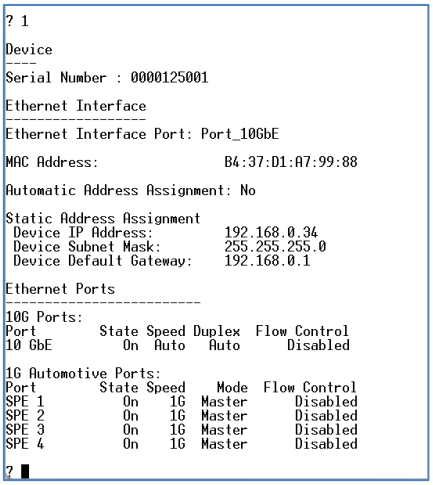


Figure 35. List of All Configuration Parameters

Some of the configuration parameters, including *Serial Number* and *MAC Address,* are read-only and cannot be changed through this interface. The updatable configuration parameters are described in Table 1, Table 2, and Table 4.

8.1.2 Change Configuration Parameters

The user can change a configuration parameter by activating this menu item. A list of names of all updatable configuration parameters will be presented to the user, see Figure 36.

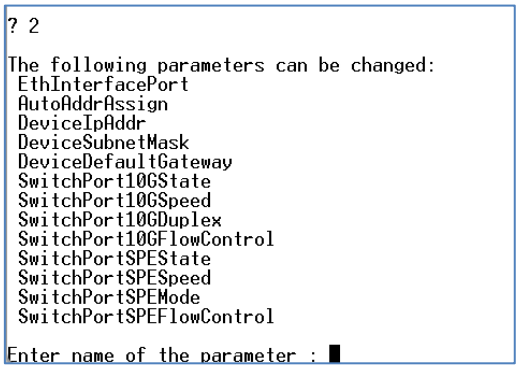


Figure 36. List of Updatable Configuration Parameters

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 *Ethernet Interface Port* configuration parameter is presented in Figure 37.

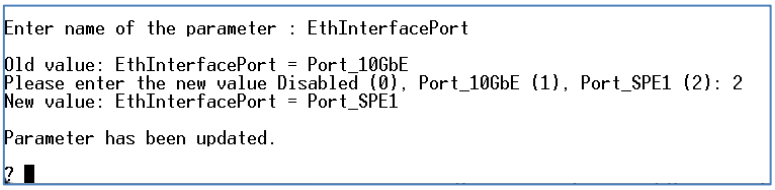


Figure 37. Changing Ethernet Interface Enabled Configuration Parameter

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

8.1.3 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 38.

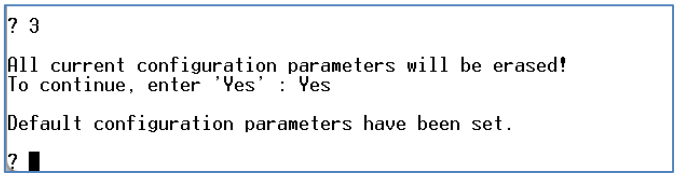


Figure 38. Setting Default Configuration Parameters

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

8.1.4 Show Device Internal State

This menu option shows the internal state of the device, see Figure 39.

The *Ethernet Switch ID* and *Ethernet Switch State* show the internal state of the device switch chip, while the *PHY ID and Temperature,* and *PHY State* show the internal state of the device PHY ships, see Figure 1.

```
? 4
Power Supply Voltage:  12.54 [V]
uC Temperature:        57.07 [Deg.C]

Ethernet Interface Port: Port_10GbE

Static Address Assignment:
 Device Address:         192.168.0.34
 Device Subnet Mask:     255.255.255.0
 Device Default Gateway: 192.168.0.1

Ethernet Switch ID:
 Product Number: 0x007
           Rev: 0x2

Ethernet Switch State:
 Switch Port #1     SPE 1: Link=  Up Speed=   1G Duplex= Full BackpressureFlowCtrl=Undef RxDFlowCtrl=   No TxDFlowCtrl=   No
 Switch Port #2     SPE 2: Link=Down Speed=Undef Duplex=Undef BackpressureFlowCtrl=Undef RxDFlowCtrl=Undef TxDFlowCtrl=Undef
 Switch Port #3     SPE 3: Link=Down Speed=Undef Duplex=Undef BackpressureFlowCtrl=Undef RxDFlowCtrl=Undef TxDFlowCtrl=Undef
 Switch Port #4     SPE 4: Link=Down Speed=Undef Duplex=Undef BackpressureFlowCtrl=Undef RxDFlowCtrl=Undef TxDFlowCtrl=Undef
 Switch Port #9    10 GbE: Link=  Up Speed=   1G Duplex= Full BackpressureFlowCtrl=Undef RxDFlowCtrl=   No TxDFlowCtrl=   No

PHY ID and Temperature:
10G PHYs:
 10 GbE: Model=  AQR113 Rev=B1 Temp=   75 [Deg.C] FirmVer=5.6.9 FirmProvID=1
1G Automotive PHYs:
  SPE 1: Model= 88Q2112 Rev=A2 Temp=   58 [Deg.C]
  SPE 2: Model= 88Q2112 Rev=A2 Temp=   61 [Deg.C]
  SPE 3: Model= 88Q2112 Rev=A2 Temp=   65 [Deg.C]
  SPE 4: Model= 88Q2112 Rev=A2 Temp=   61 [Deg.C]

PHY State:
10G PHYs:
 10 GbE: Link=  Up Speed=   1G Duplex= Full MDIStatus=  MDI
1G Automotive PHYs:
  SPE 1: Link=  Up Speed=   1G Mode=Master
  SPE 2: Link=Down Speed=   1G Mode=Master
  SPE 3: Link=Down Speed=   1G Mode=Master
  SPE 4: Link=Down Speed=   1G Mode=Master


?
```

Figure 39. Device Internal State

8.1.5 Reboot Device

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

8.1.6 Change Web Access Password

The user can reset the web access password using this option, see Figure 40.

The user will be prompted to enter and confirm the new password. The password should follow the password rules described in ***Password Update Web Page*** subsection of this document.

After successful update of the password, the user can choose to see the new password.

```
? 6
Please enter the new password   : **********
Please re-enter the new password: **********

Password has been changed successfully!

Do you want to see the new password? Yes (1), No (0) : 1

The new web access password : Axiomatic2

?
```

Figure 40. Changing Device Password

8.1.7 Save Configuration Parameters

The user can save the device configuration parameters in a file on the user's PC by activating this option. TeraTerm instructions will be provided on the screen, see Figure 41.

```
? s
Save Configuration Parameters using YMODEM protocol.
Select a folder where the file will be saved, if necessary.
In TeraTerm, to select the folder, go to: File->Change Directory...

Enter Configuration Parameter File Name : AX141590.cfg

Start file download. In TeraTerm, select: File->Transfer->YMODEM->Receive.


File: AX141590.cfg (size: 2322) has been successfully downloaded.

?
```

Figure 41. Saving Device Configuration Parameters

The device uses YMODEM protocol to download the configuration file. The user should select a directory where the configuration file will be downloaded in case it is not the default directory for file transfers. In case of TeraTerm, in the main menu, go to *File, Change Directory…*, see Figure 42.

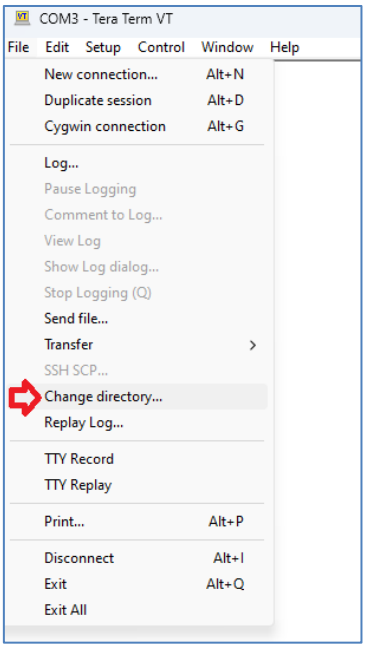


Figure 42. Changing Download Directory in TeraTerm

After entering the configuration file name, the user will be prompted to activate the YMODEM file receiving mode. In TeraTerm, in the main menu, go to *File, Transfer, YMODEM, Receive…*, see Figure 43. The device will generate and download the configuration file to the user's PC immediately after the file receiving mode is activated. The result will be shown to the user.

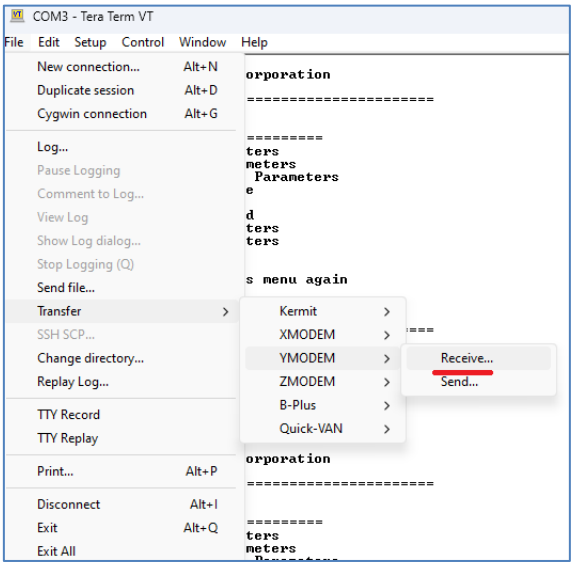


Figure 43. Activating YMODEM for Downloading Configuration File in TeraTerm

8.1.8 Load Configuration Parameters

The user can load the device configuration parameters from a configuration file by activating this option. TeraTerm instructions will be provided on the screen, see Figure 44.

```
? l
Load Configuration Parameters using YMODEM protocol.
In TeraTerm, select: File->Transfer->YMODEM->Send... and a configuration file.


File: AX141590.cfg (size: 2322) has been uploaded.

All 25 configuration parameters have been updated.
The new configuration parameters will be applied after reboot.


? 
```

Figure 44. Loading Device Configuration Parameters. Successful Result

The device uses YMODEM protocol to upload the configuration file from the user's PC to the device. The user will be prompted to activate the YMODEM sending mode and then select a configuration file to start the upload process. In TeraTerm, in the main menu, go to *File, Transfer, YMODEM, Send*, and then select a configuration file, see Figure 45.

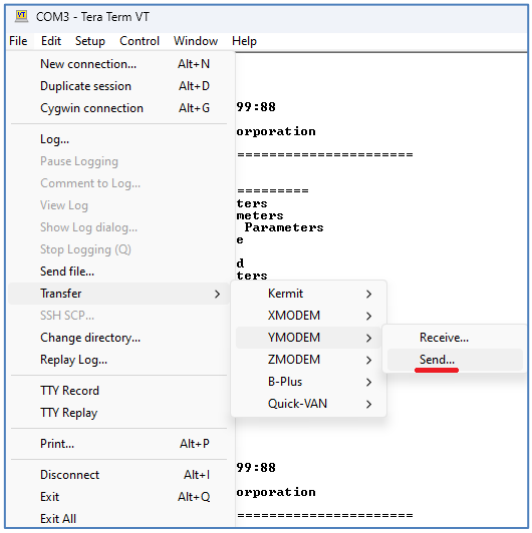


Figure 45. Activating YMODEM for Uploading Configuration File in TeraTerm

There is normally a small delay in starting the upload process, which can take up to 10 seconds to start.

The device will report the result of the file upload operation similarly to the web interface, see *Loading System Configuration* subsection of this document. In case of an error, the same detailed description of the error will be provided.

For example, if the *SwitchPortSPE2State* configuration parameter has an incorrect value of "On1" instead of "On", the following error message will be shown, see Figure 46.

```
? l
Load Configuration Parameters using YMODEM protocol.
In TeraTerm, select: File->Transfer->YMODEM->Send... and a configuration file.


File: AX141590.cfg (size: 2323) has been uploaded.

Configuration Parameter Error: 0x05 on line 26. Data Error.
Line 26: SwitchPortSPE1State       = On1


? 
```

Figure 46. Loading Device Configuration Parameters. Error in Configuration Parameter Value

8.2 Bootloader Activation

The user can activate the device bootloader using this option. The bootloader will be activated after an immediate device reboot, see Figure 47.

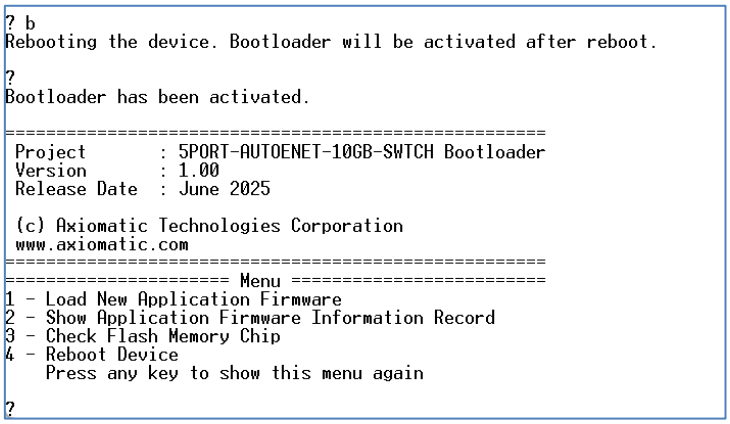


Figure 47. Activating Bootloader Menu

This activation is not permanent. Next reboot will return the device to the normal operation.

8.2.1 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 48.

Figure 48. Load Application Firmware File Prompt

The user should pick the firmware file and start the uploading process by pressing the *Ok* button, see Figure 49.

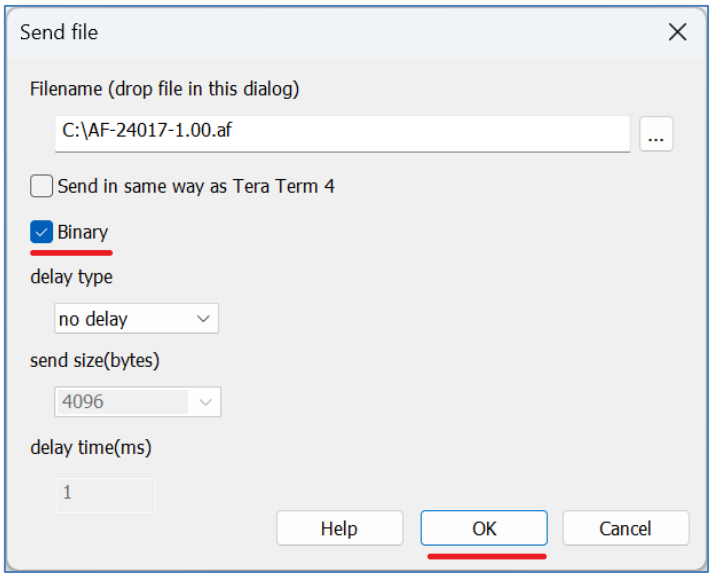


Figure 49. Selecting New Firmware

The firmware file is provided by Axiomatic in a proprietary binary format with extension: `.af`. The file name should have the following format: `AF-24017-X.XX.af`, where the `<X.XX>` field wildcard reflects the firmware version number[1].

[1] `AF-24017-1.00.af` file will be used for illustration of the firmware update process in this manual.

Once uploading of the new firmware is done, it is checked and programmed into the microcontroller and the device is restarted.

The uploading and programming processes are animated on the terminal screen. At the end of the firmware update, if no errors are encountered, the user will see the main menu of the new uploaded firmware, see Figure 50.

```
? b
Rebooting the device. Bootloader will be activated after reboot.

?
Bootloader has been activated.

=====================================================
 Project       : 5PORT-AUTOENET-10GB-SWTCH Bootloader
 Version       : 1.00
 Release Date  : June 2025

 (c) Axiomatic Technologies Corporation
 www.axiomatic.com
=====================================================
====================== Menu =========================
1 - Load New Application Firmware
2 - Show Application Firmware Information Record
3 - Check Flash Memory Chip
4 - Reboot Device
    Press any key to show this menu again

? 1

Load Application Firmware File.
Use Menu: File->Send File... with XON/XOFF control and "Binary File" options.
**************************************************************************************
**************************************************************************************
*************
Application firmware file has been loaded successfully to the internal flash memory.
Programming application firmware...
Checking firmware integrity...
Programing firmware...
**************************************************************************************
**************************************************************************************
Checking checksum...
Finalizing flashing operation...
Application firmware has been successfully programmed.
Rebooting the device...

=====================================================
 Project       : 5PORT-AUTOENET-10GB-SWTCH
 Version       : 1.00
 Release Date  : June 2025

 Part Number   : AX141590
 Serial Number : 0000125001

 MAC Address   : B4:37:D1:A7:99:88

 (c) Axiomatic Technologies Corporation
 www.axiomatic.com
=====================================================
Health Status : Normal

=============== Menu =================
1 - Show Configuration Parameters
2 - Change Configuration Parameters
3 - Set Default Configuration Parameters
4 - Show Device Internal State
5 - Reboot Device
6 - Change Web Access Password
```

Number of '*' depends on the file length

```
s - Save Configuration Parameters
l - Load Configuration Parameters
t - Virtual Cable Tester
b - Activate bootloader
    Press any key to show this menu again

?
```

Figure 50. Uploading New Firmware

If something goes wrong, an error message will be displayed, and the whole process will be terminated.

8.2.2 Show Application Firmware Information Record

This menu option is intended to show the user a description of the application firmware programmed into the microcontroller during the last firmware update, see Figure 51.

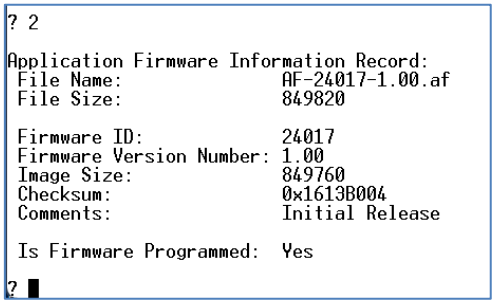


Figure 51. Application Firmware Information Record

The application firmware file name is only available when the firmware was updated through the web interface.

8.2.3 Check Flash Memory Chip

This auxiliary menu option shows information of the flash memory chip installed in the device.

8.2.4 Reboot Device

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

9 TECHNICAL SPECIFICATIONS

9.1 Power Supply

Table 7. Power Supply Input

Parameter	Value	Remarks
Supply Voltage	9 to 36 VDC	12 V, 24 V – nominal
Standby Supply Current[1]	372 mA	12 V – typical[3]
	190 mA	24 V – typical[3]
Maximum Supply Current[2]	555 mA	12 V – typical[3]
	378 mA	24 V – typical[3]
Standby Supply Current Decrease per Disabled Ethernet Port	18 mA	12V, 10Gbps port – typical[3]
	42 mA	12V, 1Gbps port – typical[3]
	9 mA	24V, 10Gbps port – typical[3]
	21 mA	24V, 1Gbps port – typical[3]
LED Indicator	Power ON	Green LED
Protection	Overvoltage, Reverse Polarity, Transients/Surge	

[1]All Ethernet ports are set at maximum speed, enabled, and disconnected.
[2]All Ethernet ports are set at maximum speed, enabled, and connected.
[3]At room temperature (25 °C)

9.2 Ethernet Switch

Table 8. Ethernet Switch Parameters

Parameter	Value	Remarks
Number of Ports	5	1 port – 10 Gbps, 10 GbE port 4 ports – 1 Gbps, SPE 1…4 ports All ports are Individually configurable
Switch Type	Unmanaged	Based on Marvell 88Q6113, with individually configurable PHYs, based on Marvell AQR113 (10 GbE) and Marvell 88Q2112 (SPE ports)
Switching Capacity	28 Gbps	
Forwarding Rate	20.83 Mpps	
MAC Address Table	16 K Entries	16384 address database entries
Packet Buffer Memory	2 Mbit	
Jumbo Frame	10236/10240 bit	Tagged/Untagged frames
QoS	8 Priority Queues	
	802.1p/DSCP QoS	
10GbE Port		
Port Type	10GBASE-T, 5GBASE-T, 2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-Te	IEEE 802.3an/bz/ab NBASE-T IEEE 802.3-2012 compliant auto-negotiation Port can be disabled to save power and for security reasons.
MDIX	Auto-MDIX	Automatic A/B and C/D pair swaps, polarity inversions, and semi-cross (A/B or C/D only)
Port Speed	10 Gbps, 5 Gbps, 2.5 Gbps, 1 Gbps, 100 Mbps, 10 Mbps	Configurable or auto-negotiation
Port Duplex	Full Duplex	Resolved to full-duplex, if auto-negotiation

Parameter	Value	Remarks
Flow Control	Available	Individually configurable RxD and TxD IEEE 802.3x PAUSE frame-based flow control
Port LED Indicator	Link/Speed/Activity	RGB LED
SPE Ports		
Port Type	1000BASE-T1	IEEE 802.3bp-2016
	100BASE-T1	IEEE 802.3bw-2015
Port Speed	1 Gbps / 100 Mbps	Individually configurable per port
Port Mode	Master/Slave	Individually configurable per port
Flow Control	Available	Individually configurable RxD and TxD IEEE 802.3x PAUSE frame-based flow control
Port LED Indicator	Link/Speed/Activity	Red-green bicolor LED
Communication Protocols	Ethernet IEEE 802.3, IP, ICMP, ARP, UDP, TCP, DHCP, HTTP, Proprietary[1]	For internal web server and proprietary discovery protocol on 10GbE or SPE 1. Communication with the switch over Ethernet can be disabled for security reasons.
Web server	On 10GbE or SPE 1 port only	Used for configuration, diagnostics, and flashing application firmware. Supports configuration files. Password protected. Can be disabled
Internal Diagnostics	Health Status	Available from the web server or RS-232 port user interface
RS-232 Port	3-wire	Local alternative to the web server. Menu based text user interface[2]. YMODEM for upload/ download configuration files

[1] Proprietary discovery protocol is supported by Axiomatic `AxioDisc.exe` Windows console application and *CAN-ENET Software Support Package* (SSP), P/N AX140910, v3.0.0+.
[2] Use any terminal emulation software, TeraTerm is preferred (free download from: https://teratermproject.github.io/index-en.html).

9.2.1 LED Indicators

9.2.1.1 10GbE Port

Table 9. 10GbE Port LED

LED Color[1]	Port Speed
Off	No Link
Green	10 Mbps
Yellow	100 Mbps
Red	1 Gbps
Violet	2.5 Gbps
Blue-green	5 Gbps
Blue	10 Gbps

[1]Transmit or receive activity on the Link if blinking

9.2.1.2 SPE Ports

Table 10. SPE Port LED

LED Color[1]	Port Speed
Off	No Link
Yellow	100 Mbps
Red	1 Gbps

[1]Transmit or receive activity on the Link if blinking

9.2.2 RS-232 Port

Table 11. RS-232 Port Settings

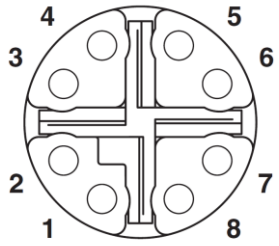
Parameter	Value	Remarks
Bit Rate	115200 bps	
Data	8-bit	
Parity	None	
Stop	1 bit	
Flow Control	Xon/Xoff	For flashing new application firmware only

9.3 Ethernet Connectors

9.3.1 10GbE Port

M12 socket, 8-pin, X-coded, shielded female connector, Phoenix Contact, P/N 1411964. Use X-coded mating connectors compliant with IEC 61076-2-109.

Table 12. 10GbE Port Connector Pinout

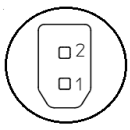
PIN #	Description	
1	DA+	
2	DA-	
3	DB+	
4	DB-	
5	DD+	
6	DD-	
7	DC-	
8	DC+	

For 10GbE cable requirements see Appendix A.

9.3.2 SPE Ports

M12 socket, 2-pin, shielded female connector, Phoenix Contact, P/N 1363344. Use 2-pin SPE mating connectors compliant with IEC 63171-5.

Table 13. SPE Port Connector Pinout

PIN #	Description	
1	TRD+	
2	TRD-	

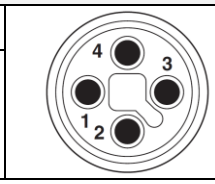
For SPE cable requirements see Appendix A.

9.3.3 Power Connector

M12 socket, 4-pin, T-coded, male connector, Phoenix Contact, P/N: 1412017. Use T-coded mating connectors compliant with IEC 61076-2-111.

Table 14. Power Connector

PIN #	Description	
1	RS232_TX	
2	RS232_RX	

PIN #	Description	
3	BATT+	
4	BATT- (RS232_GND[1])	

[1] RS-232 Ground is connected to BATT-.

9.4 General Specifications

Table 15. General Specifications

Parameter	Value	Remarks
Operating Temperature	-40 to +65 °C (-40 to 149 °F)	
Storage Temperature	-40 to +85 °C (-40 to 185 °F)	
Environmental Protection	IP67	IEC 60529. With mated connectors
Size	TBD	L x W x H excluding connectors. See dimensional drawing
Weight	TBD	
Compliance	RoHS Directive	

9.5 Housing

Cast aluminum, anodized enclosure. Lexan overlay. For dimensional drawing, see Figure 52.

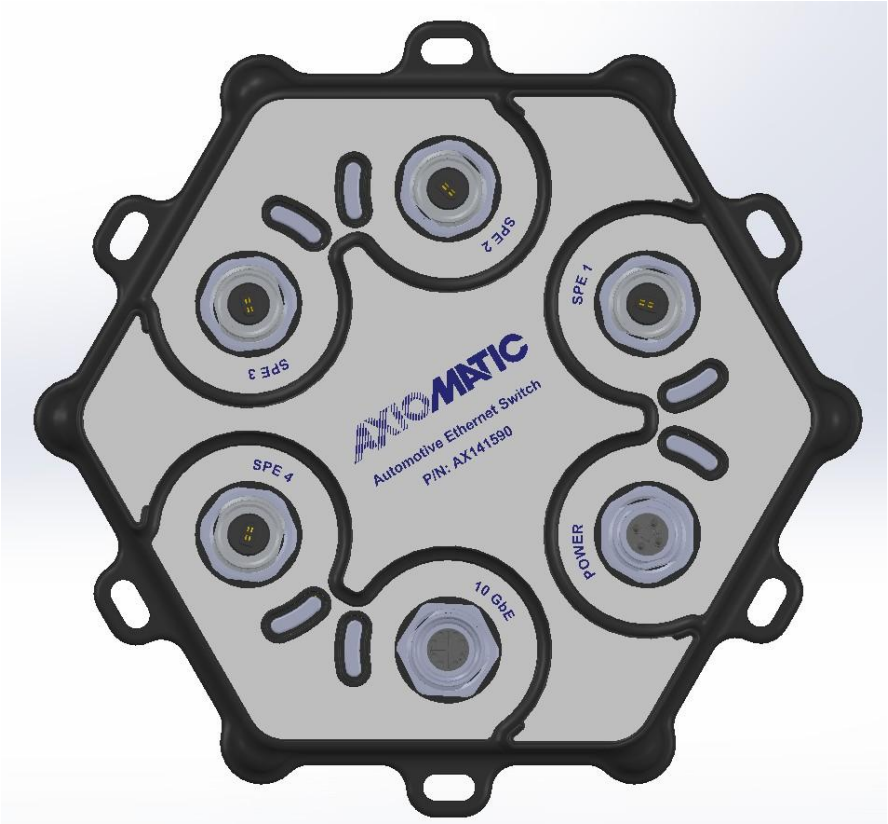


Figure 52. Dimensional Drawing (TBD)

10 APPENDIX A. Ethernet Cable Requirements

10GbE Port

Table A1. 10GbE Port Cable Requirements

Port Speed	Cable Category	Maximum Distance[1]	Cable Standard
10 Gbps	CAT 7 STP (or better)	100m	ISO/IEC 11801-1:2017 Class F
	CAT 6a UTP	100m	ANSI/TIA-568.2-D
	CAT 6	55m	
5 Gbps, 2.5 Gbps	CAT 5e (or better)	100m	
1 Gbps, 100 Mbps, 10 Mbps	CAT 5e (or better)	130m	

[1]Based on the PHY rating

SPE Ports

SPE ports utilize a single balanced twisted pair with 100 Ohm characteristic impedance. The cable characteristics should meet or exceed the appropriate Ethernet standard, see Table A2.

Table A2. SPE Cable Requirements

Port Speed	Cable Type	Segment Type	Frequency Range	Maximum Cable Insertion Loss[1]	Maximum Distance	Ethernet Standard
1 Gbps	UTP, STP	B (Optional Segment)	1-600 MHz	8.5 dB @ 100MHz	40m	IEEE 802.3bp-2016
				13.8 dB @ 250 MHz		
				22.3 dB @ 600 MHz		
	UTP	A (Automotive Segment)	1-600 MHz	6.1 dB @ 100 MHz	15m	
				9.9 dB @ 250 MHz		
				15.9 dB @ 600 MHz		
100 Mbps	UTP	-	1-66 MHz	2.6 dB @ 10 MHz	15m	IEEE 802.3bw-2015
				4.9 dB @ 33 MHz		
				7.2 dB @ 66 MHz		

[1] At maximum cable length. For other cable characteristics see the appropriate Ethernet standard.

Depending on the application, the following cable standards can be used for selecting the SPE cable, see Table A3.

Table A3. SPE Cable Standards

Application	Cable Standard
Automotive	OPEN Alliance TC9, Channel and Components Requirements for 1000BASE-T1 Link Segment Type A (STP). OPEN Alliance TC9, Channel and Components Requirements for 1000BASE-T1 Link Segment Type A (UTP).
Commercial and Industrial	ISO/IEC TR 11801-9906 (T1-B cable type or better for 100BASE-T1, 1000BASE-T1 Type A, B) IEC 61156-11 (Horizontal floor wiring. T1-B cable type parameters) IEC 61156-12 (Work area wiring. T1-B cable type parameters)

11 APPENDIX B. 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 B1. Third Party Software License Notices

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12 VERSION HISTORY

User Manual Version	Firmware version	Date	Author	Modifications
1C	1.xx	October 15, 2025	Olek Bogush	• Updated requirements for *Network Configuration Parameters.*
1B	1.xx	September 15, 2025	Olek Bogush	• Corrected *Axiomatic Discovery Application* and *Configuration File Format* subsections. • Added port names to *Ethernet Switch Parameters* table in *Technical Specifications* section.
1A	1.xx	July 14, 2025	Olek Bogush	• Corrected *SPE Cable Standards* table in *Appendix A*. Updated *Acronyms* section.
1	1.xx	June 23, 2025	Olek Bogush	• Initial release.

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