Technical Bulletin
PAVIRO Network Configuration Guide – v1.1

Related Products:
PAVIRO Controller PVA-4CR12

Severity:
☐ Immediate action required
☐ Action strongly recommended
☒ Informative

PAVIRO Network Configuration Guide

This Technical Bulletin describes the configuration of a PAVIRO network.

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1. Introduction

This Technical Bulletin covers the configuration of a specific Barox switch for use with a PAVIRO network. The interface, shown in the Technical Bulletin, is specific for the Barox LT-802GBTME switch. Other switches will have different management interfaces.
The parameters shown in the examples reflect common configurations for PAVIRO hardware and can be implemented on any managed switch – which meets the switch specification.
QoS and VLANs are also covered in the network configuration guide, although they are not required for completeness.

Notice!
For EN54-16 systems, the Barox LT-802GBTME switch must be used and in case fiber connectors are required the AC-SFP-SX-E or AC-SFP-LX-E-10 SFP modules. See also the PAVIRO Declaration of Performance (DoP).

Please order the switch directly at Barox by using the following order reference: “LT-802GBTME-BO”. You will receive a LT-802GBTME switch with certified hardware and firmware.
The certified switch and firmware can be found at the Barox website by using “LT-802GBTME-BO”.

2. Basics

The Barox LT-802GBTME switches should be configured as follows:

IP address
- Generally individual IP addresses are mandatory for all networks with multiple devices.
- Switches are allowed to have identical IP addresses in case no access to the web interface is needed.

Firmware
- Same switch firmware and boot loader is mandatory for all networks with multiple switches.
- See the Barox LT-802GBTME manual for more details about firmware and boot loader updating.
- Use the switch firmware listed in the DoP.
  Example: IRIS-Net 4.0 is certified with the switch firmware v2.8.1b.

Rapid Spanning Tree Protocol (RSTP)
- For redundant connection (ring, mesh) of multiple racks.
- Mandatory for all networks where ring or mesh connections are used.

Notice!
The use of RSTP requires firmware v2.8.1.b or above.

Ethernet Ring Protection Switching (ERPS)
- ERPS prevents the formation of loops in a LAN.
- Mandatory for all networks where ring connections are used (alternative to RSTP).

Notice!
Either ERPS or RSTP protocol can be used, but not both at the same time.

Green Mode / Green Ethernet
- Feature for saving energy in Ethernet switches during periods with low network activity.
- Green Mode very likely causes synchronization issues on a Dante network with device clocks drifting away from the system-wide clock. Thus the Green Mode needs to be completely deactivated.

Notice!
The Barox LT-802GBTME does not have a Green Mode!

Fault contact
- The switch has to transfer a fault information to the PA system (via fault relay).
- The configuration of the fault relay has to be done individually to fit the system wiring.

Internet Group Management Protocol (IGMP) Snooping
- This is a feature for the control of multicast traffic.
- The IGMP Snooping function analyzes IGMP packets between hosts and multicast routers.
- If IGMP snooping is active, but no querier is defined, it can cause problems with the audio master and thus needs to be disabled.

Storm Protection
- This is a feature for saving bandwidth.
- If the Broadcast/Unicast/Multicast storm is over a certain threshold, the switch will automatically filter out the broadcast frames.
- This function can cause problems with the audio network and the IRIS-Net Device Scan. Thus storm protection options need to be disabled.

System Log
- The logging function records the events that occur in the switch.
- This function helps to understand the activity of the switch and diagnose problems.

Quality of Service (QoS, optional)
- Settings can be optimized for use with Dante/OMNEO.
- Mandatory for all networks with different kind of data traffic, which needs prioritized, guaranteed or limited bandwidth.
- QoS is not needed for a PAVIRO network, these details are provided for completeness.

Virtual LANs (VLAN, optional)
- Virtual LANs (Local Area Network) are used to separate a physical LAN into multiple logical sub-networks.
- Trunk Ports:
  - For easy connection of multiple racks with VLANs.
  - Trunk ports must carry all VLANs.
  - Mandatory for all networks where multiple switches and VLANs are used.
- VLANs are not needed for a PAVIRO network, these details are provided for completeness.

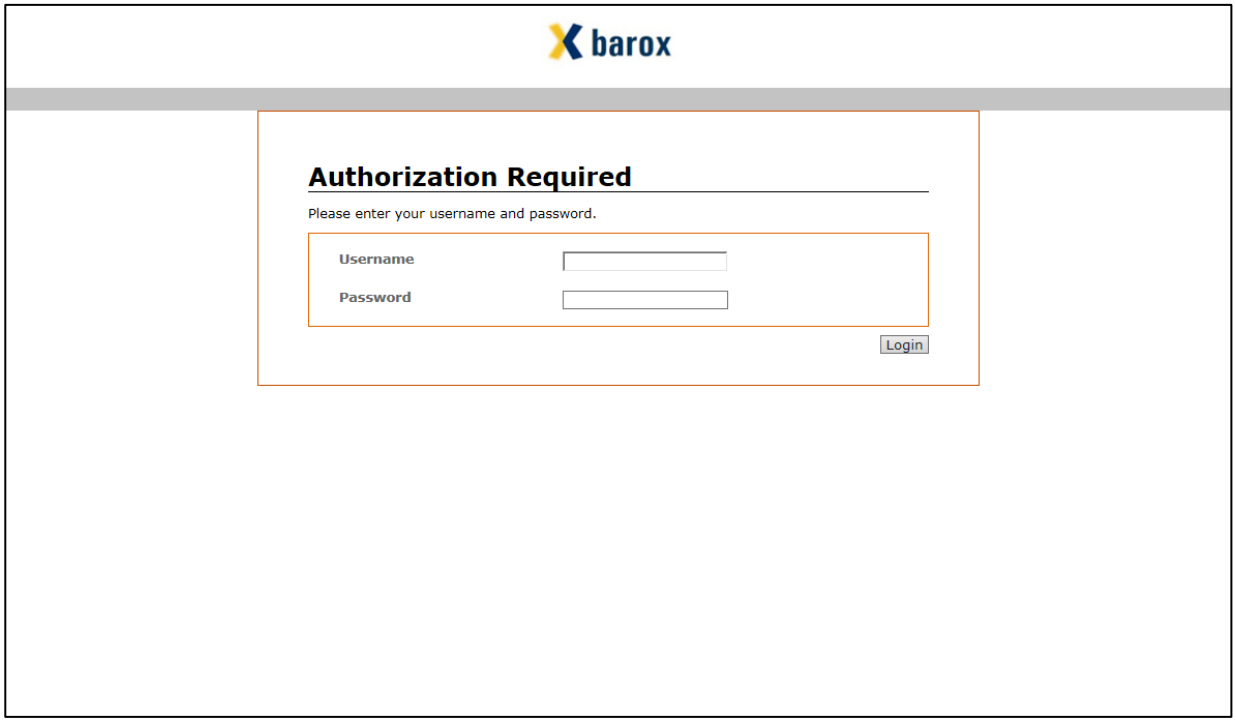
Notice!
Save the configuration.
After making changes to the switch configuration do not forget to save the configuration permanently – otherwise the configuration will be lost after a reboot.

3. Configuration

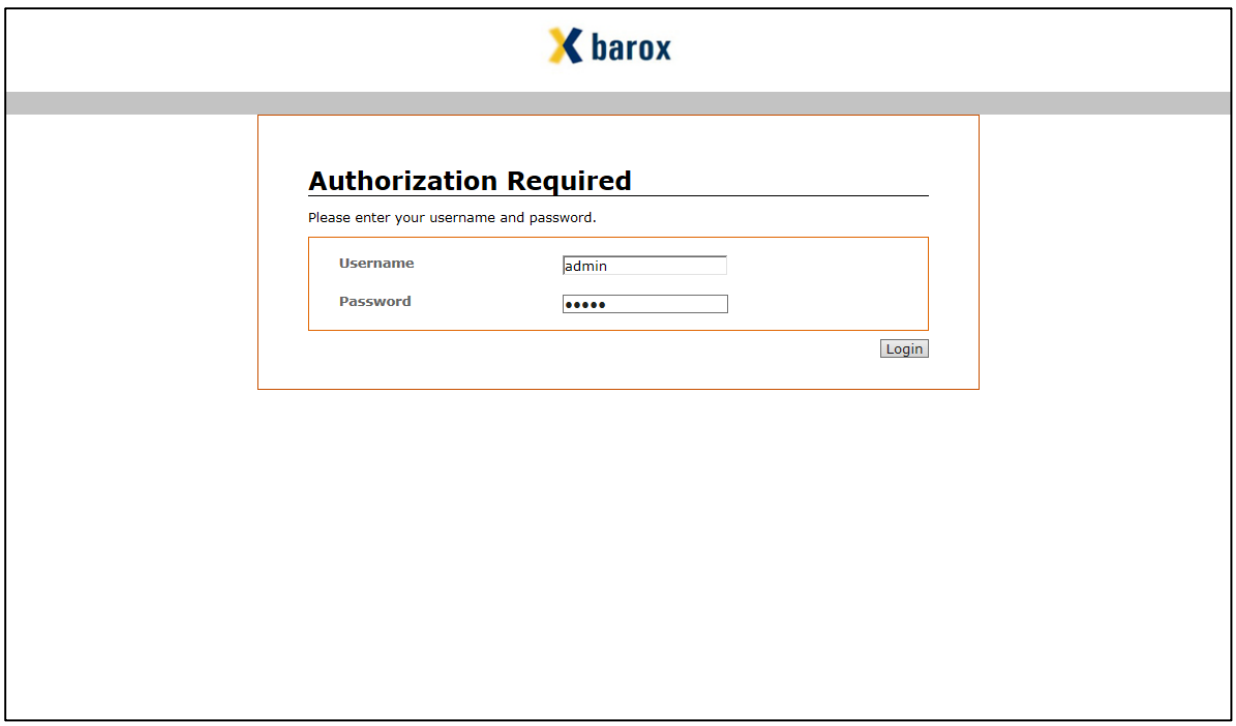
3.1. General Configuration via Webserver

Connect and login

1. Connect to the switch's default IP address 192.168.1.254 via the web browser.



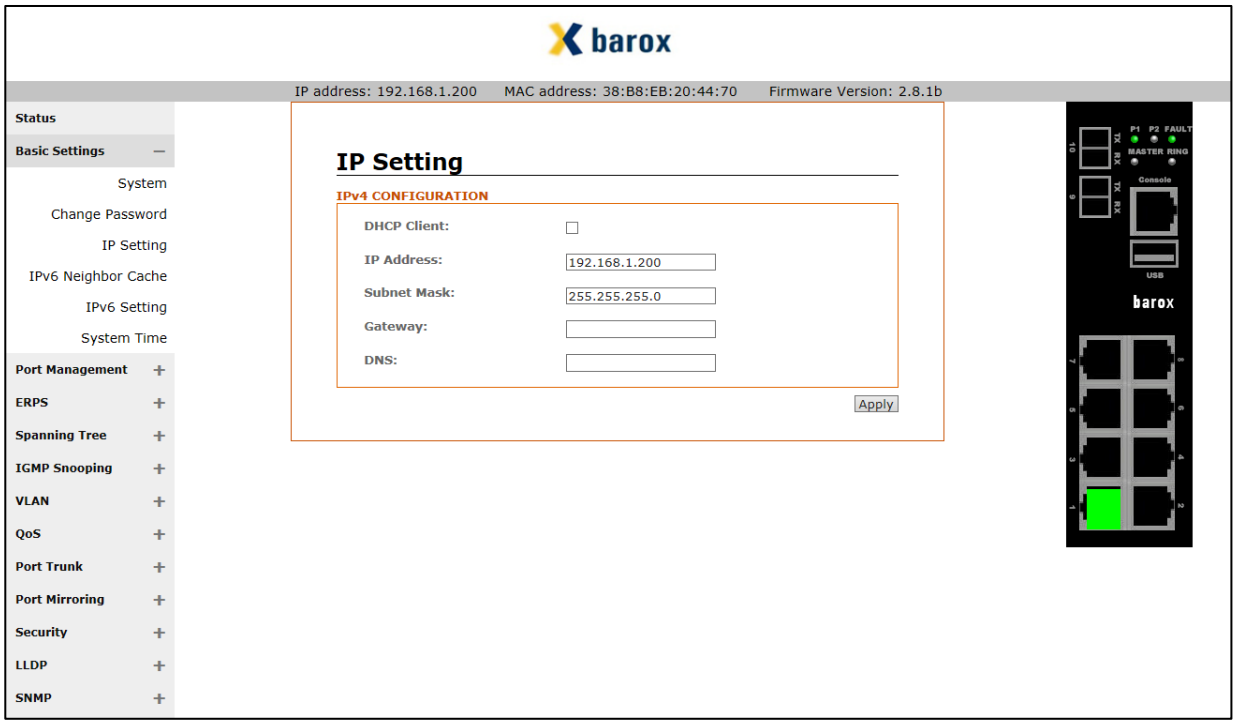
2. Enter user name "*admin*" and password "*admin*" and click on the *Login* button.



Notice!
The default user name and password might be changed. Please enter the correct user name and password instead.

Change IP address

1. Go to *Basic Settings* > *IP Setting*.
2. Change *IP Address* and *Subnet Mask*.
3. Change *Gateway address* and *DNS address* (optional).
   If you have a network with multiple (interconnected) Subnets, a Gateway can be defined.
4. Click on the *Apply* button.
5. Reconnect to the new IP address and log in again.

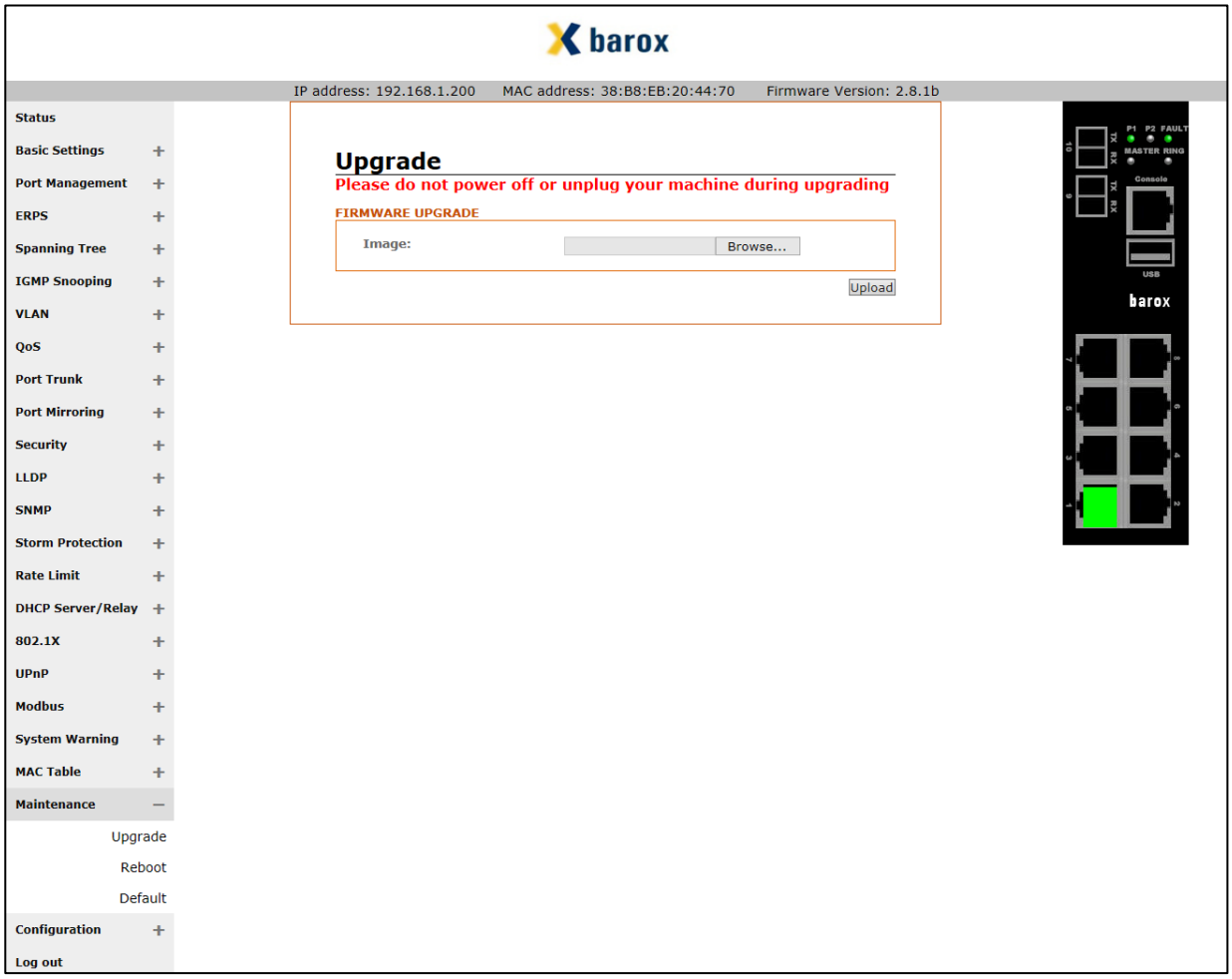


Notice!
The label-based audio routing used by Audinate's Dante protocol, will not support multiple Subnets and works only in a single Subnet with flat hierarchy. Other Audio Routing implementations, like direct Routing over Audio Routed Network Interface (ARNI), are currently NOT supported in IRIS-Net and PAVIRO.

Firmware

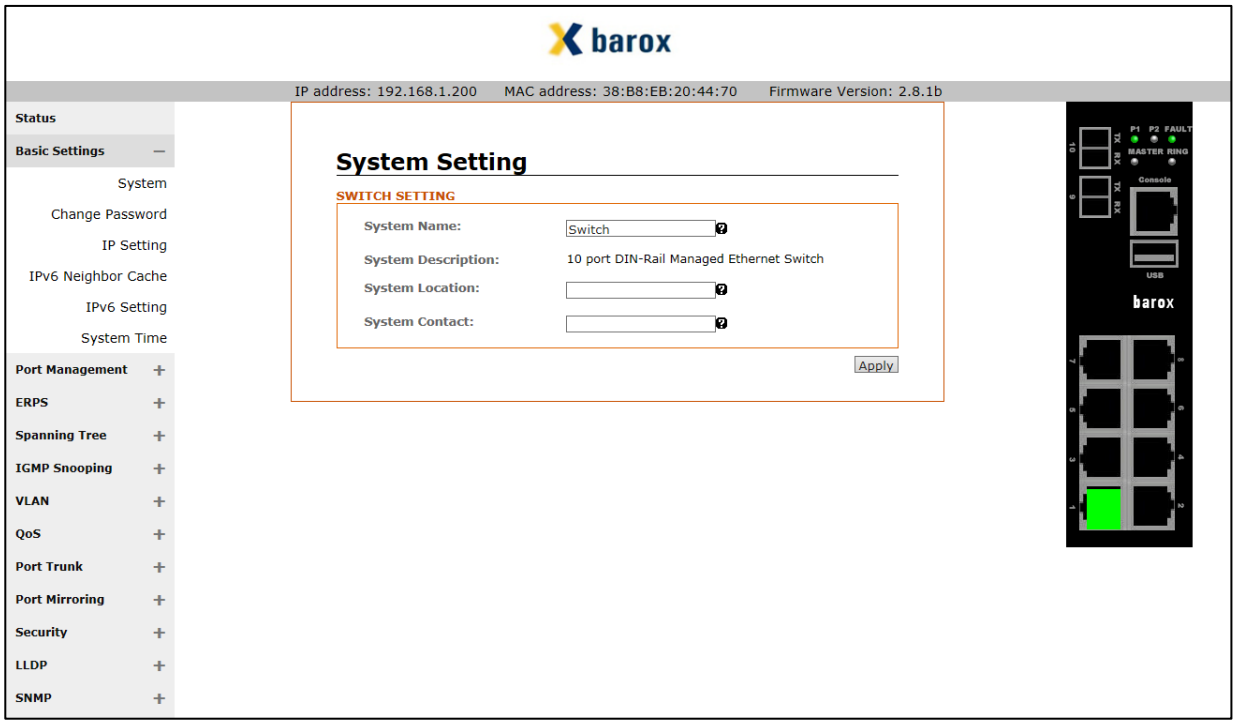
1. Check the *Firmware Version* in the grey bar on the top of the window.
2. If an update is necessary go to *Maintenance* > *Upgrade* and make an update.

Notice!
Please check the DoP to ensure the correct firmware is used.



Edit location and name

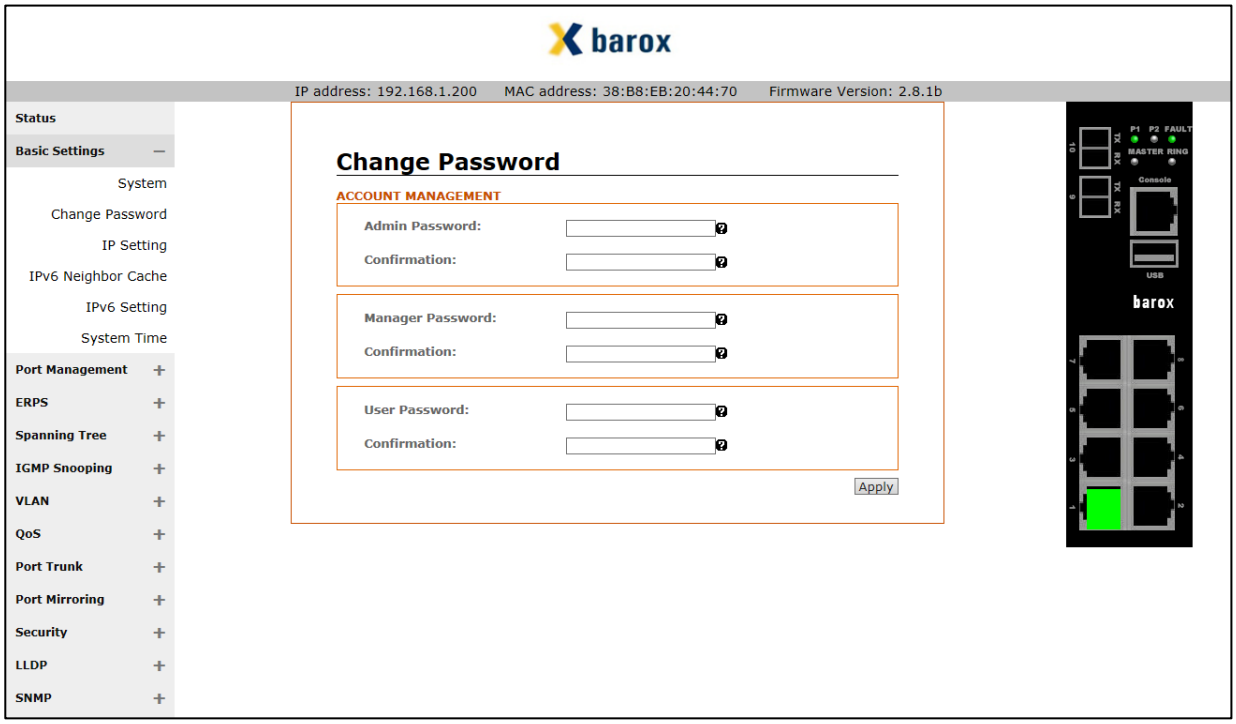
1. Go to *Basic Settings* > *System*.
2. Under *Switch Setting* enter a *System Name* and a *System Location*.



Change Admin password

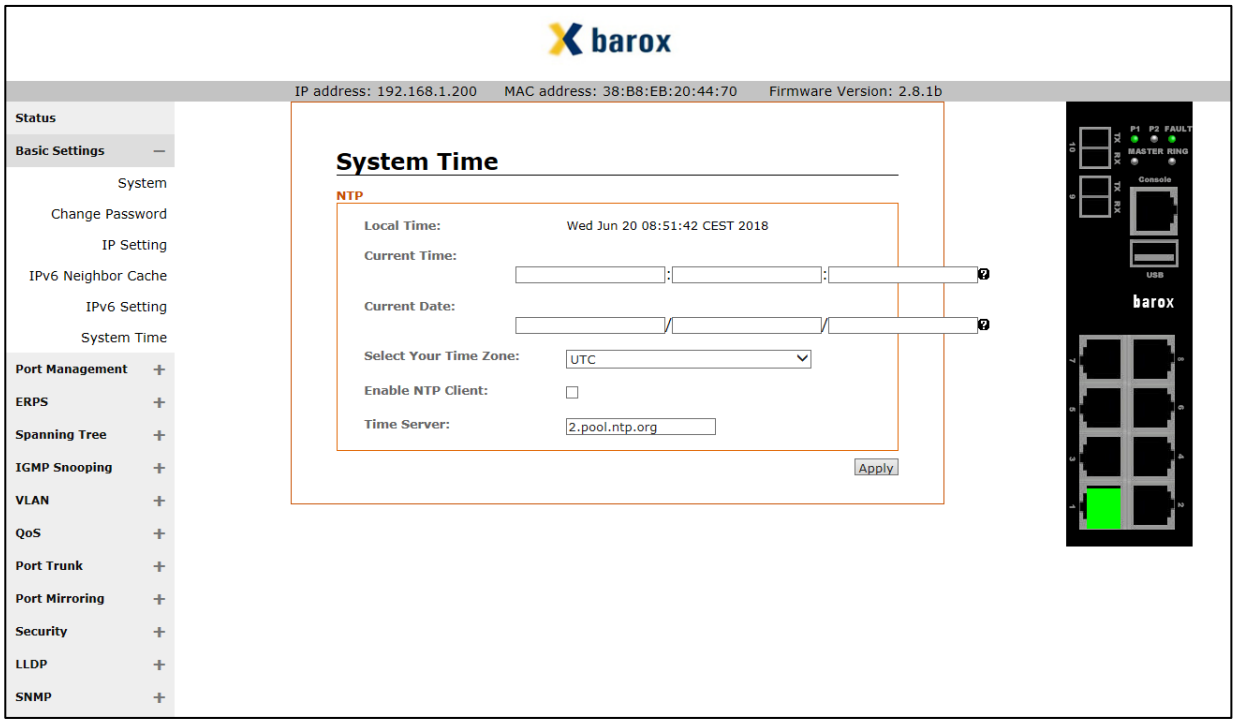
1. Go to *Basic Settings* > *Change Password*.
2. Under *Admin Password* enter or edit the password of the administrative account.

Notice!
Please change this password for every switch in your network, to comply with EN54-16 standards.



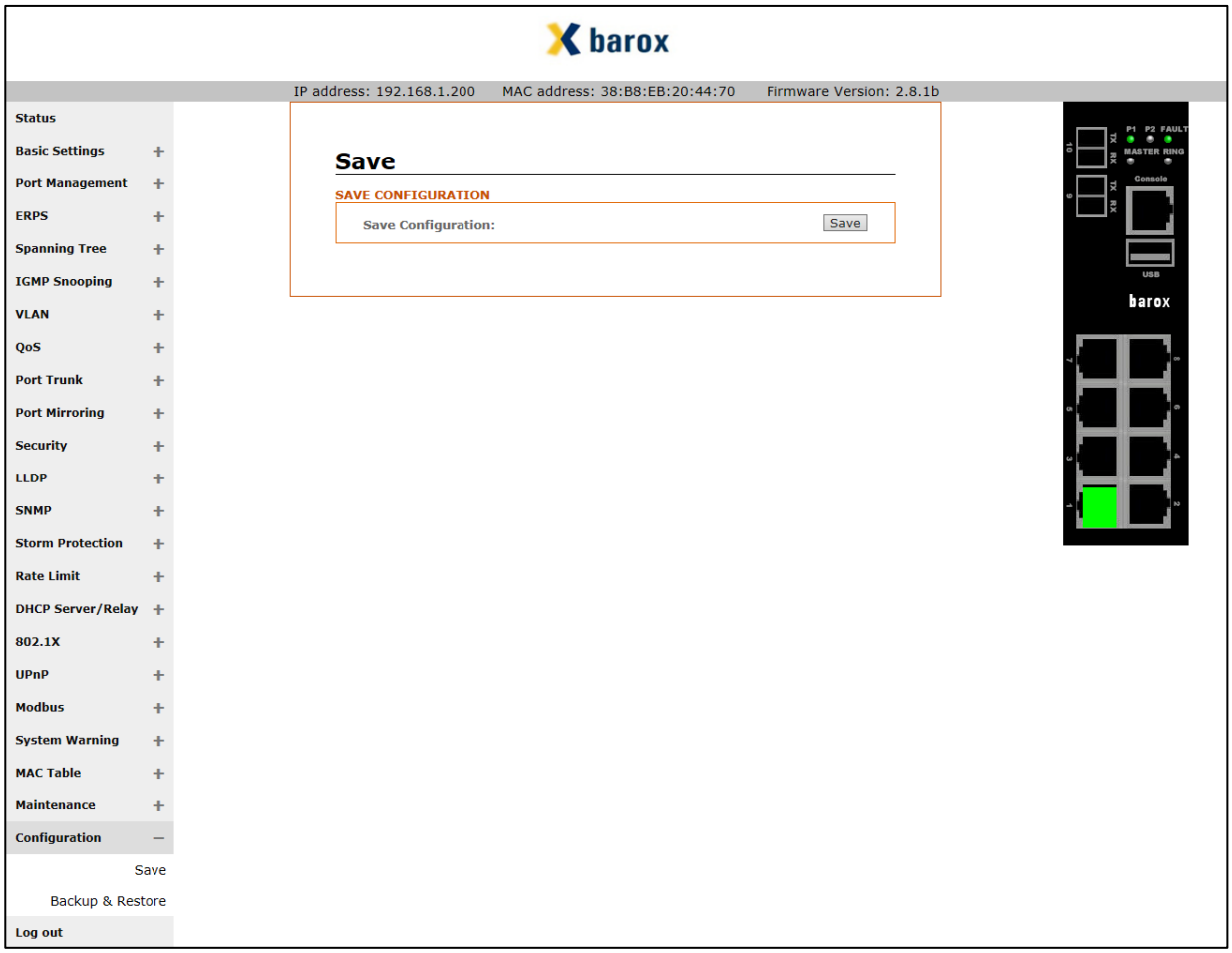
Edit System Time

1. Go to *Basic Settings* > *System Time*.
2. Set the time of the switch to the time of the PAVIRO controller.



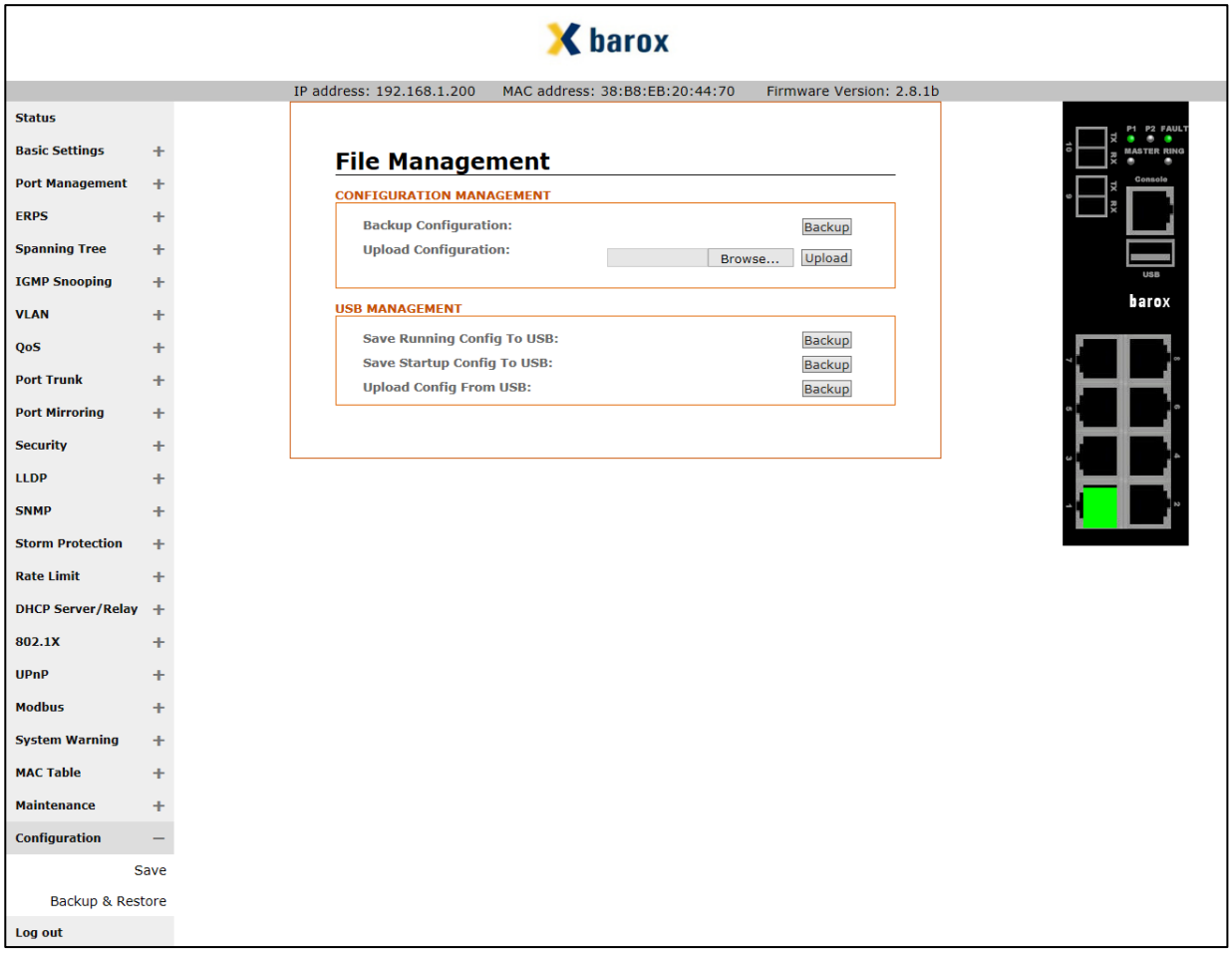
Save running configuration on the switch

1. Go to *Configuration* > *Save*.
2. Save the running configuration as startup configuration by clicking the *Save* button.



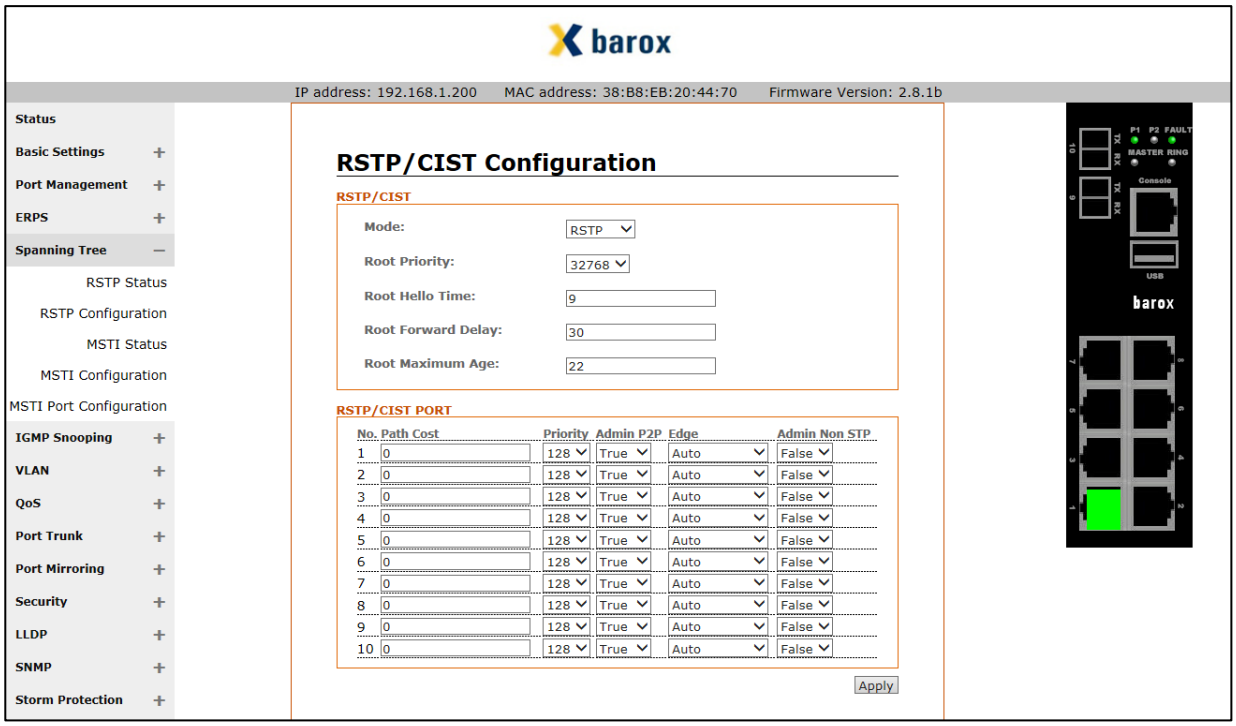
Save running or startup configuration as a file on a PC or USB drive

1. Go to *Configuration* > *Backup & Restore*.
2. Under *Configuration Management* click the *Backup* button to download the startup configuration file on your PC.
3. Under *USB Management* click the *Backup* button to save the running or the startup configuration to the USB drive connected to the switch.



3.2. RSTP configuration

1. Go to *Spanning Tree* > *RSTP Configuration*.
2. Activate Rapid Spanning Tree Protocol.
3. Under *RSTP / CIST* make the following settings:
   - Mode: RSTP
   - Root Priority: 32768
   - Root Hello Time: 9
   - Root Forward Delay: 30
   - Root Maximum Age: 22
4. Under *RSTP / CIST PORT* make the following settings:
   - Path Cost: 0
   - Priority: 128
   - Admin P2P: True
   - Edge: Auto
   - Admin Non STP: False
5. Click on the *Apply* button.

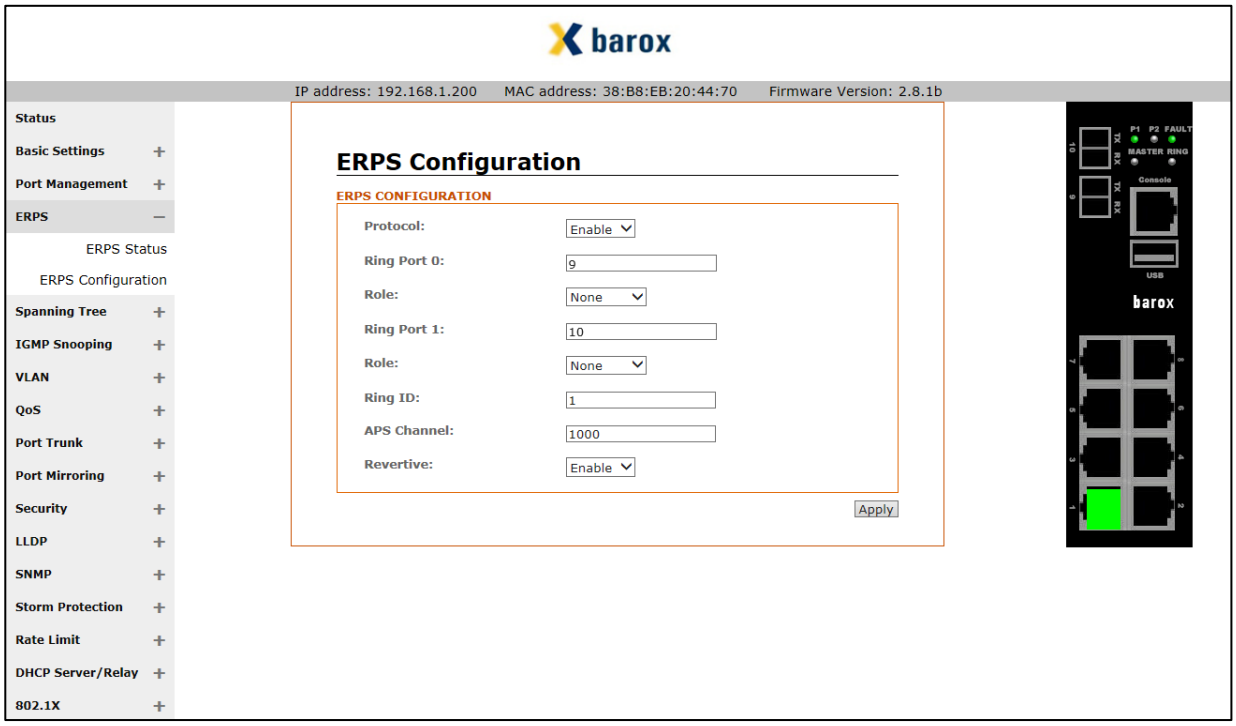


Notice!
Do not forget to save the changes made!

3.3. ERPS configuration

Do not close the ring, before all switches are configured as follows and all nodes in the topology are ready.
If redundant cabling between racks is required, only one OMNEO output is allowed to be connected to the local network device and the network devices need to be included into the same cabinet as the controllers. This is only valid if ERPS is active.

1. Before configuring ERPS, you need to disable spanning tree protocol (STP), because only one of these two protocols can be active in a switch.
2. Go to *ERPS* > *ERPS Configuration*.
3. Enable Ethernet Ring Protection Switching.
4. Under *ERPS CONFIGURE* make the following settings:
   - Protocol: Enable
   - Ring Port 0: Set the port which is used as first port for the ring
   - Role: None
   - Ring Port 1: Set the port which is used as second port for the ring
   - Role: None
   - Ring ID: Type in an ERPS ring ID (range: 1 – 239)
   - APS Channel: Type in an ERPS APS Channel ID (range: 1 – 4094)
     It cannot be the same ID as the existing VLAN IDs!
     (Default VLAN ID: 1)
   - Revertive: Enable (The revertive mode has no impact, if the ring ports have no role)
5. Click on the *Apply* button.



Notice!
Do not forget to save the changes made!

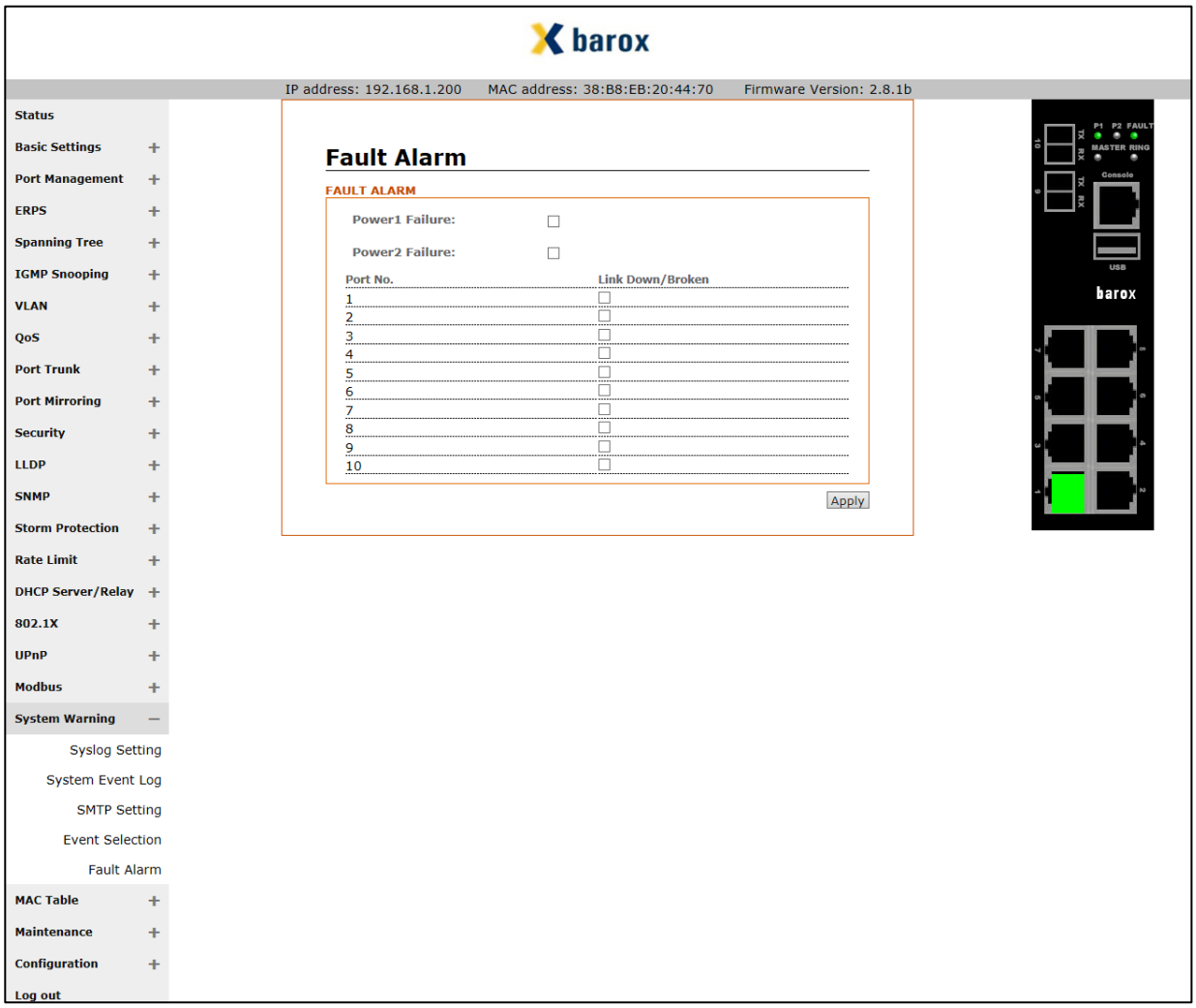
3.4. Green Mode

1. The Green Mode has to be disabled.
2. The Barox LT-802GBTME does not have a Green Mode. There is no setting to be done for the Barox LT-802GBTME.

Notice!
If you are using another switch, you have to completely deactivate the Green Mode for all ports.

3.5. Fault Contact

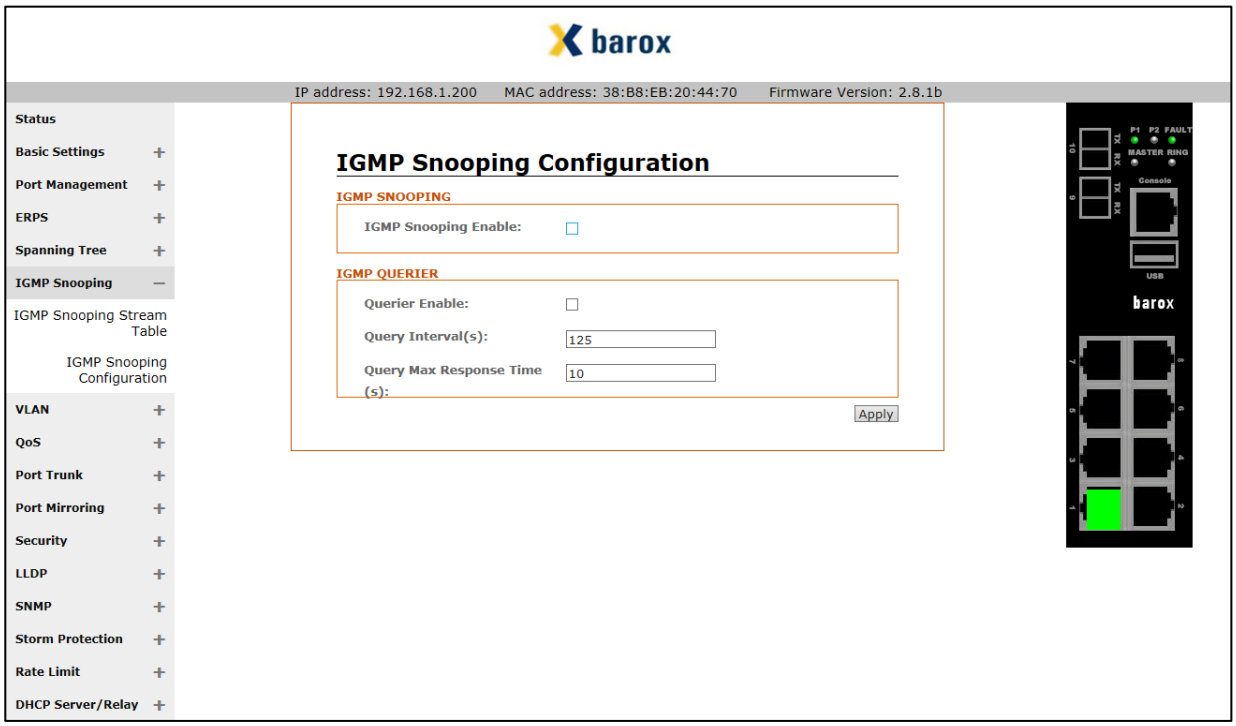
1. Go to *System Warning* > *Fault Alarm*.
2. Configure due to the requirements of the system, when the Fault Alarm should be active.
3. Click the *Apply* button.



Notice!
Do not forget to save the changes made!

3.6. IGMP Snooping

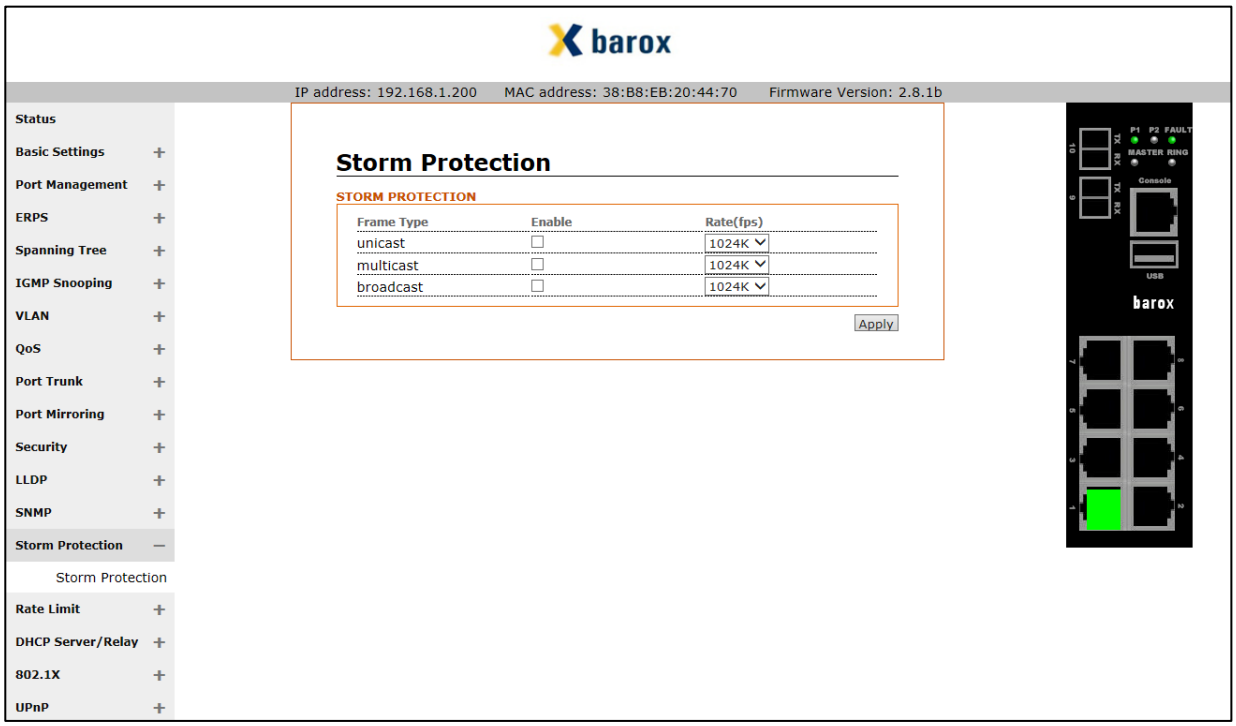
1. Go to *IGMP Snooping* > *IGMP Snooping Configuration*.
2. Disable IGMP Snooping.
3. Click the *Apply* button.



Notice!
Do not forget to save the changes made!

3.7. Storm Protection

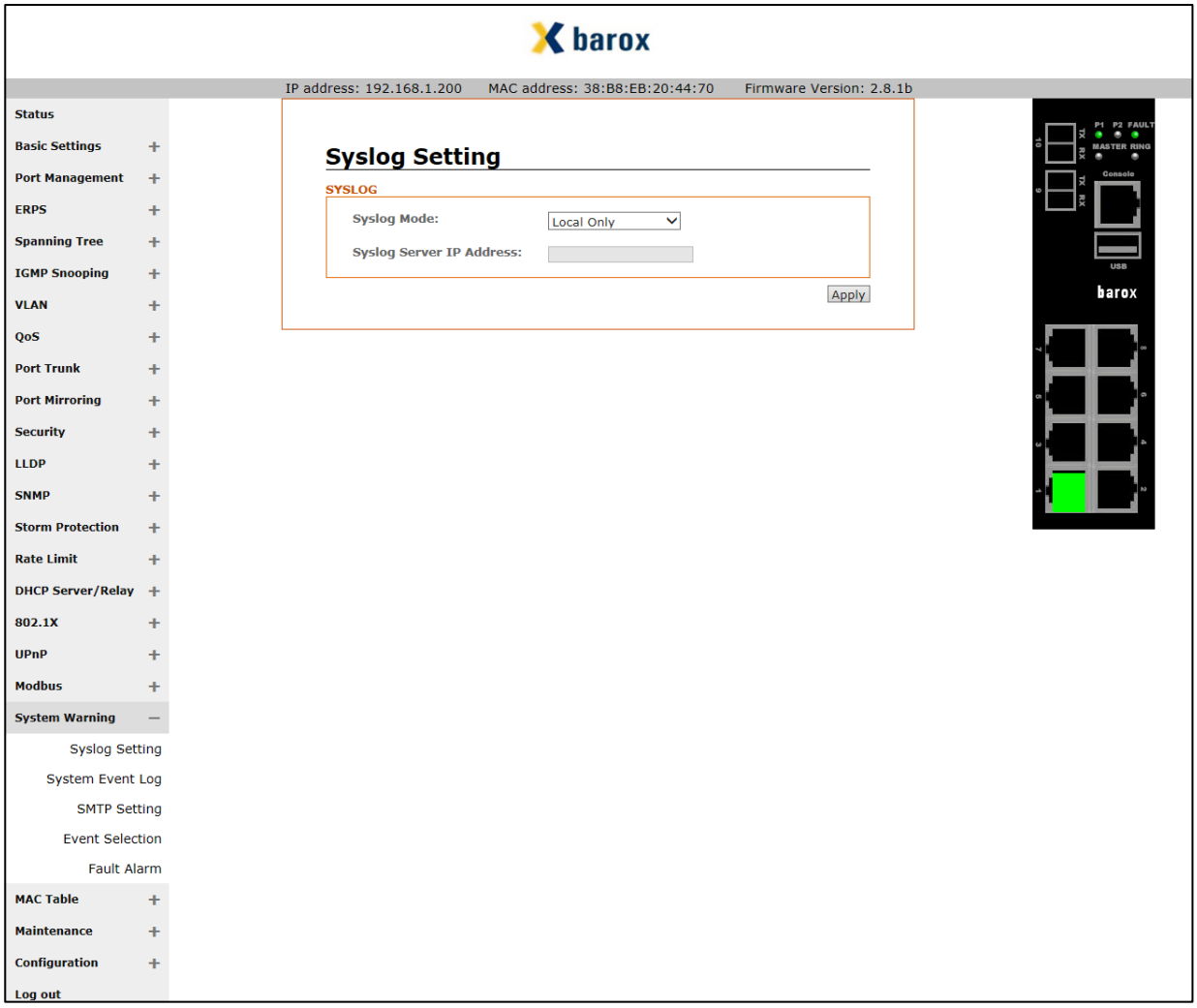
1. Go to *Storm Protection* > *Storm Protection*.
2. Disable all protection options.
3. Click the *Apply* button.



Notice!
Do not forget to save the changes made!

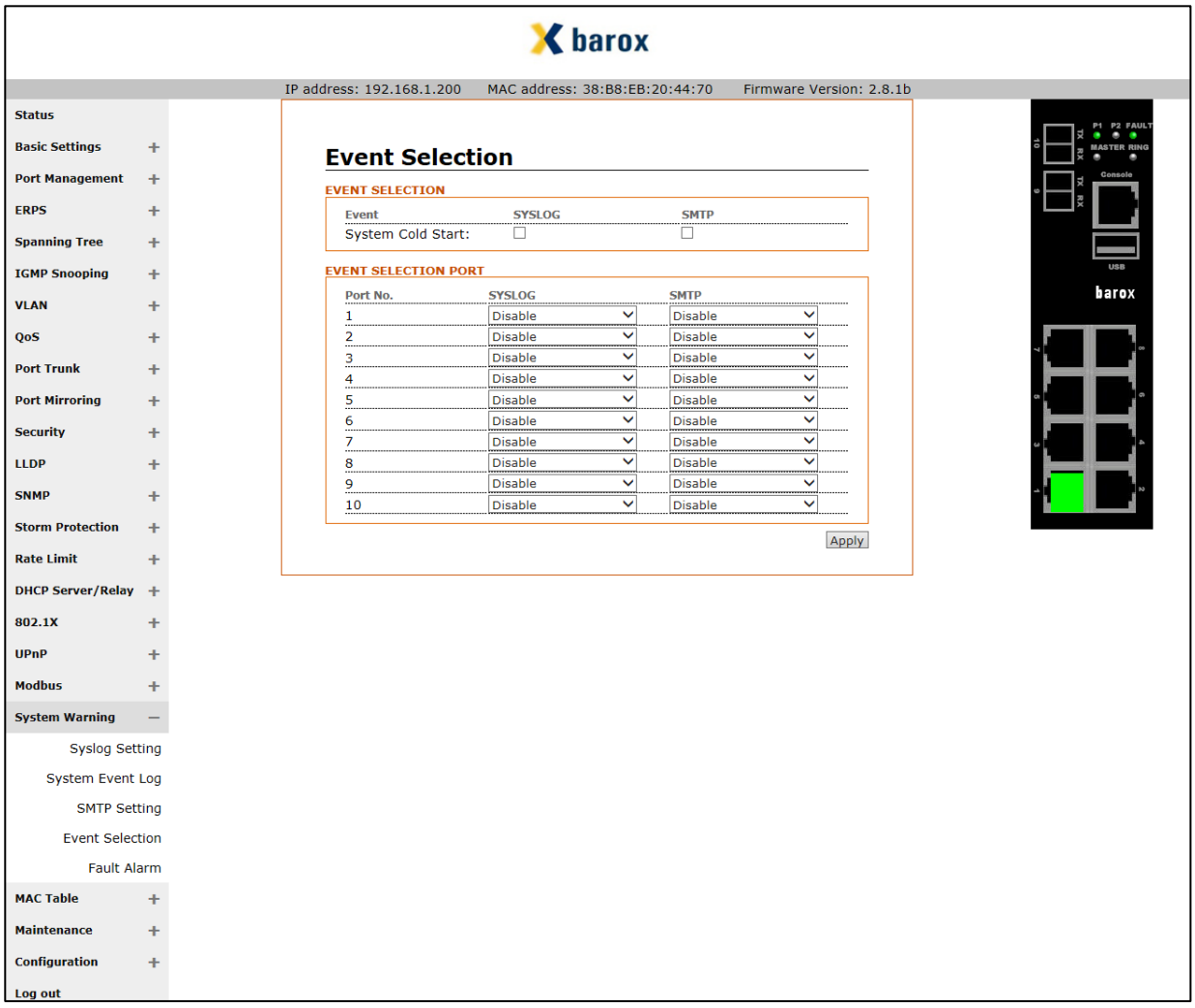
3.8. System Log

1. Go to *System Warning* > *Syslog Setting*.
2. Enable the Syslog by choosing *Local Only, Remote Only* or *Local and Remote* as Syslog Mode.
3. Click the *Apply* button.



Notice!
Do not forget to save the changes made!

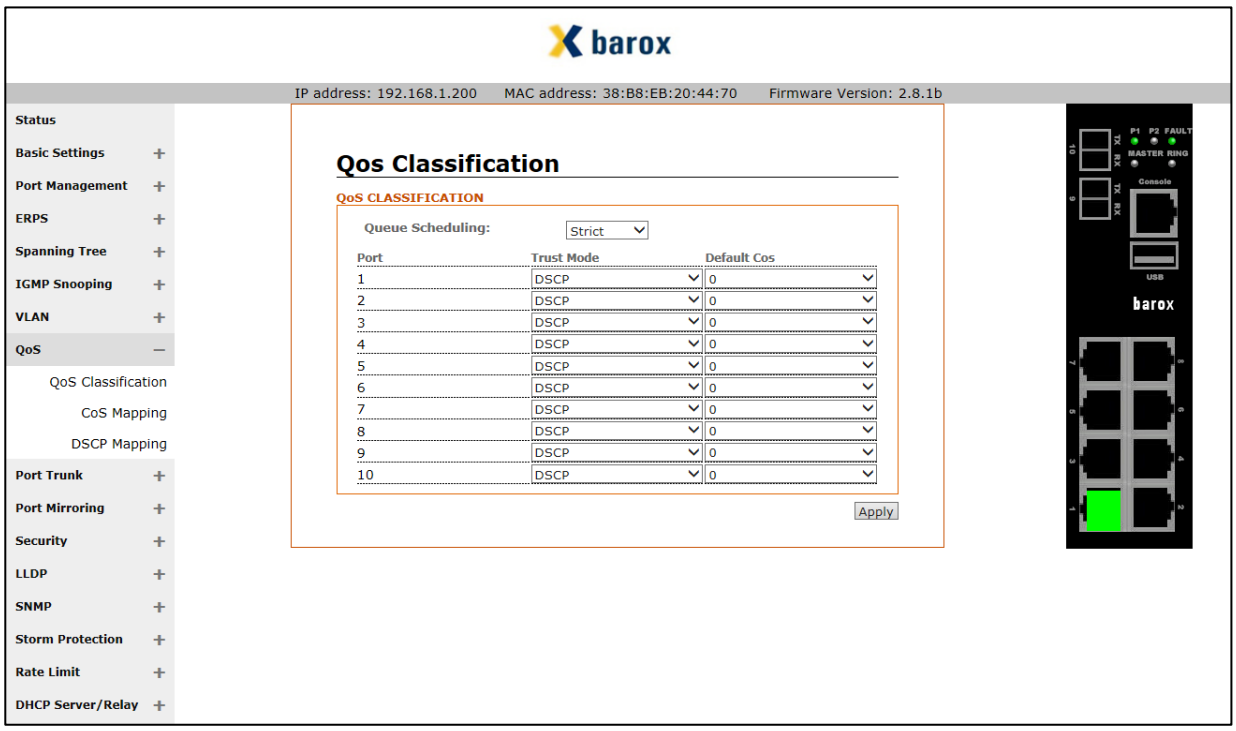
4. Go to *System Warning* > *Event Selection*.
5. Configure due to the requirements of the system, which events should be logged.
6. Click on the *Apply* button.



Notice!
Do not forget to save the changes made!

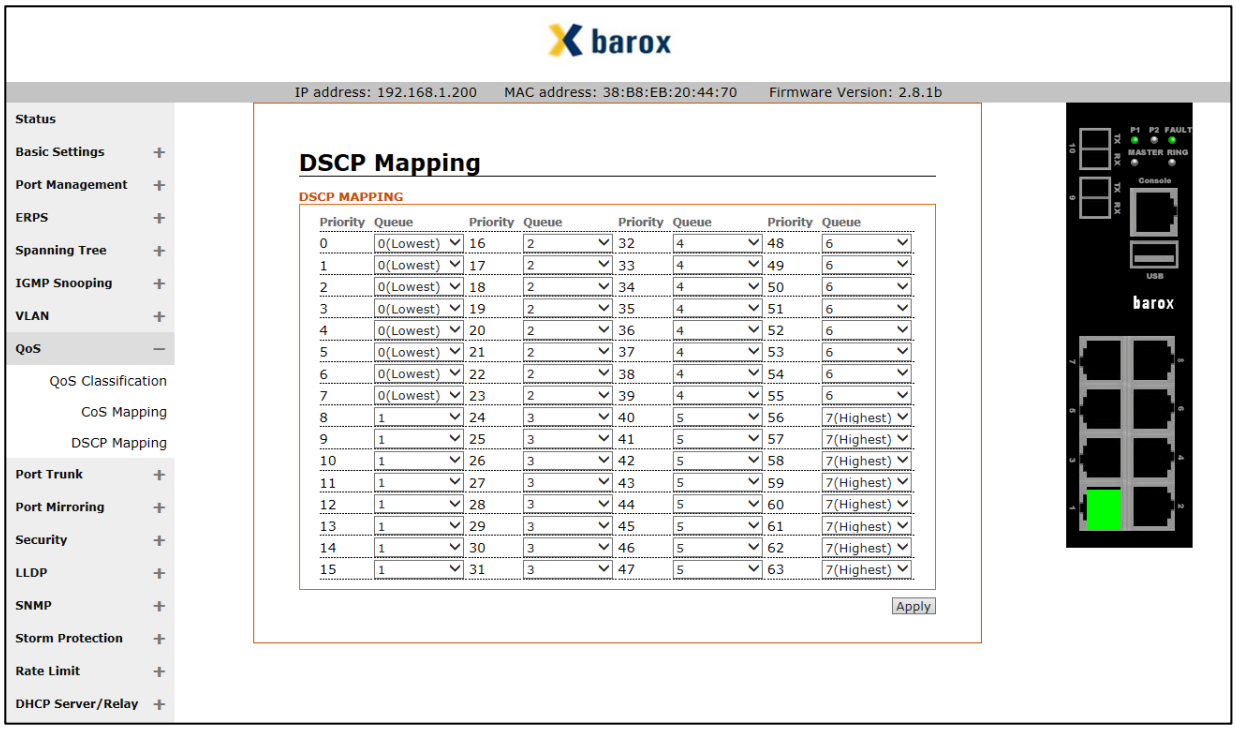
3.9. QoS configuration (optional)

1. Go to *QoS* > *QoS Classification*.
2. Under *QoS Classification* make the following settings:
   - Queue Scheduling: Strict
   - Trust Mode: DSCP
3. Click on the *Apply* button.



Notice!
Do not forget to save the changes made!

4. Go to *QoS* > *DSCP Mapping*.
5. Make sure that the settings in the *DSCP Mapping* table look like the ones in the table below.
6. Click on the *Apply* button.



Notice!
Do not forget to save the changes made!

3.10. VLAN configuration (optional)

In this example Port 1-3 belong to VLAN1 and Port 4-6 belong to VLAN2. Port 7-10 are so called trunk ports and are used for the interconnection of the switches and transport both VLANs.

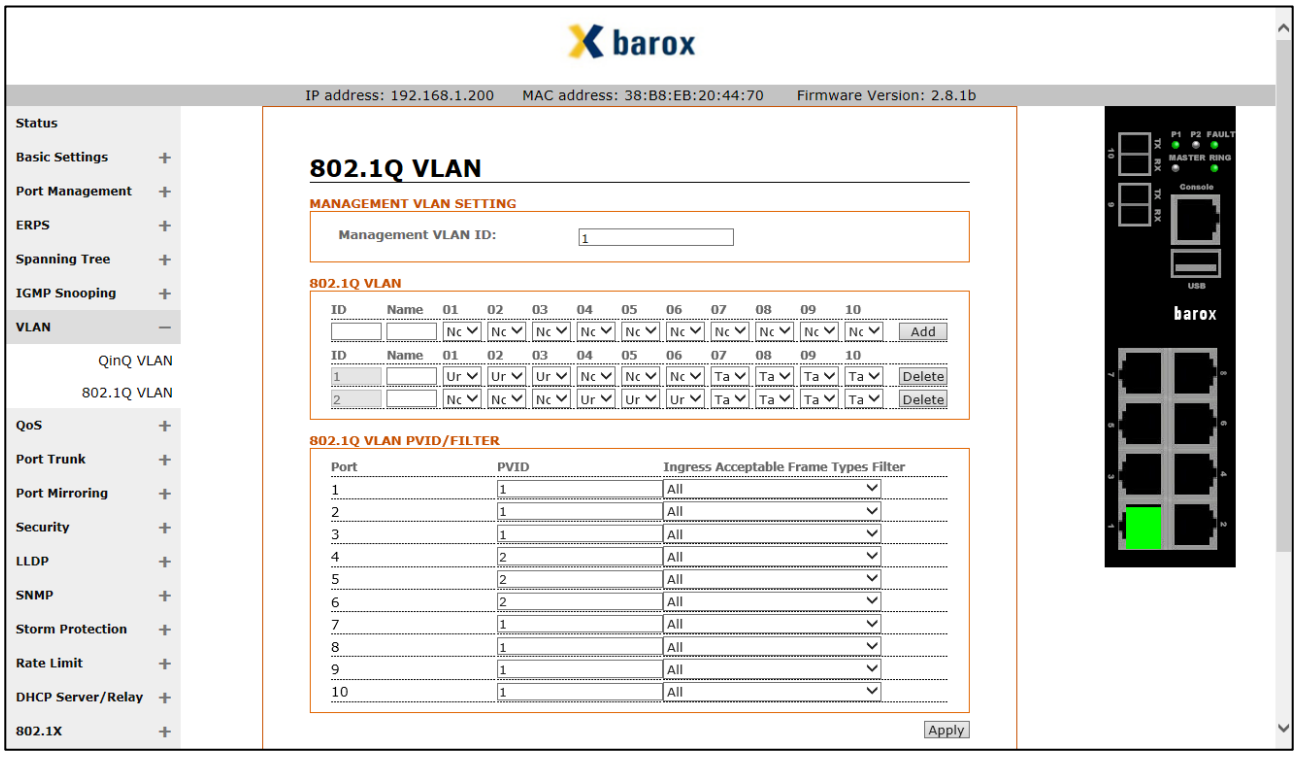
1. Go to *802.1Q VLAN* > *802.1Q VLAN*
2. Under *802.1Q VLAN* create a second VLAN by clicking on the *Add* button and enter VLAN ID 2
3. Make the following settings for the two VLANs:

VLAN1	Port 1-3:	Untag	VLAN2	Port 1-3:	None
	Port 4-6:	None		Port 4-6:	Untag
	Port 7-10:	Tag		Port 7-10:	Tag

4. Under *802.1Q VLAN PVID* configure which port belongs to which VLAN and if a port filter should be active.

Port 1-3:	PVID 1	Ingress Acceptable Frame Types Filter:	All
Port 4-6:	PVID 2	Ingress Acceptable Frame Types Filter:	All
Port 7-10:	PVID 1	Ingress Acceptable Frame Types Filter:	All

   Thus you can access the web interface of the switch although when connecting to the trunk ports.
5. Click on the *Apply* button.

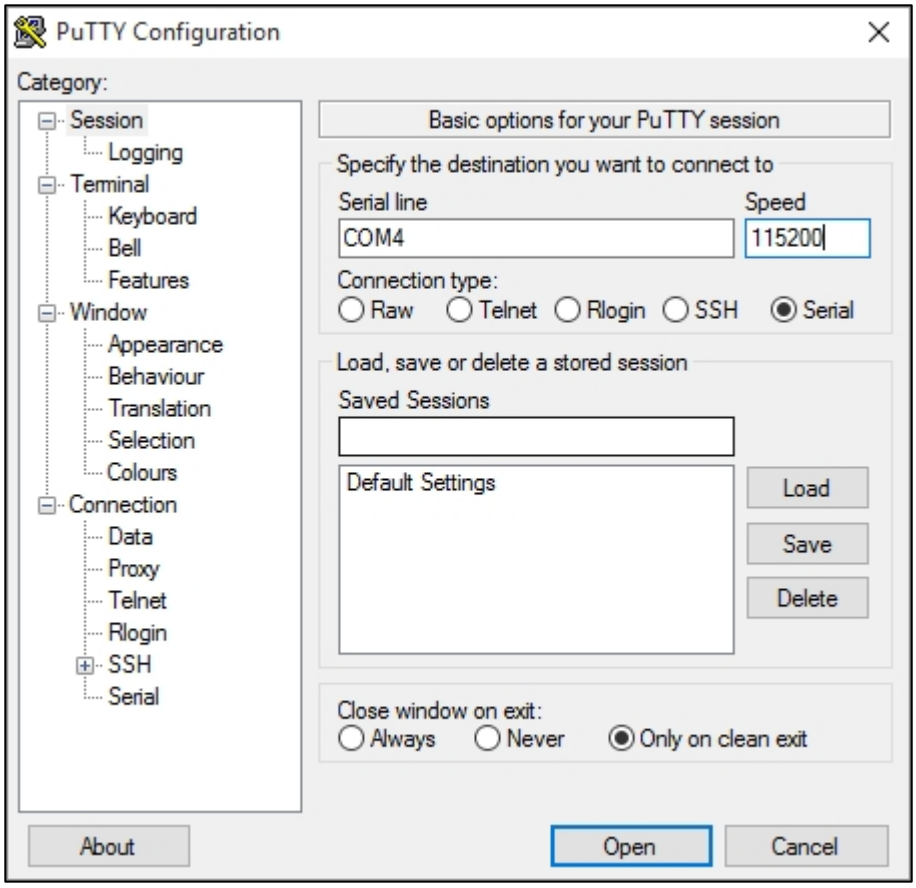


Notice!
Do not forget to save the changes made!

3.11. IP Configuration via Serial Console (optional)

You can change the IP address of the switch either via serial connection or via web browser. In this chapter you will see, how to change the IP address via serial connection.

Start PuTTY and select the appropriate COM Port and a Speed or rather a Baudrate of 115200. The Putty default settings (8 Databits, 1 Stop Bit, Parity = None, Flow Control = XON/XOFF) can stay unchanged.



Open Serial session in PuTTY

1. Logon to switch with the following credentials:
   - Username: admin
   - Password: admin

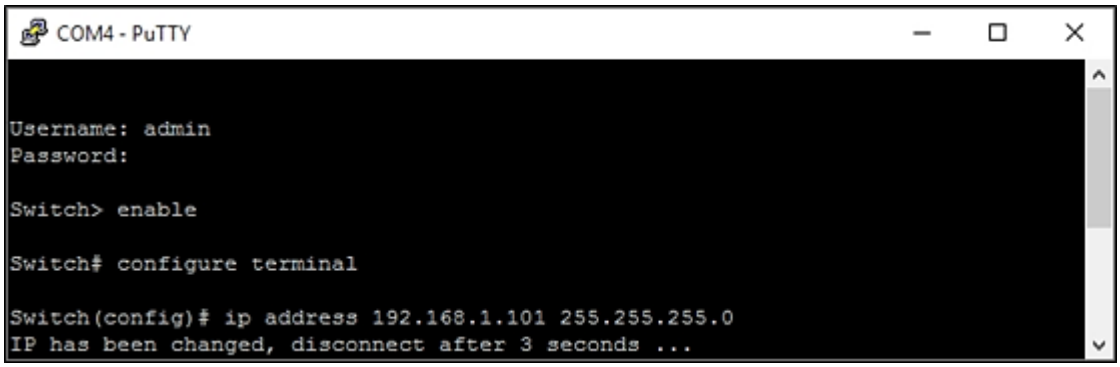
   Note: Logon credentials can be changed later via web interface.

2. Obtain privileged session rights:
   Enter "*enable*" in the console and confirm with Enter keypress.

3. Switch from Run-Mode to Configuration-Mode:
   Enter "*configure terminal*" and confirm with Enter keypress.

4. Change the IP address of the currently connected switch:
   - Enter "*ip address XXX.XXX.XXX.XXX YYY.YYY.YYY.YYY*"
   - The first portion of this command, the XXX.XXX.XXX.XXX part, must be replaced with a valid IP address (e.g. 192.168.1.101). Please remember that the device IP address within a network segment must be unique.
   - The second portion of the command, the YYY.YYY.YYY.YYY part, defines the Netmask for the Subnet. This must be replaced with an appropriate Netmask that fits your subnet. In most cases this will be: 255.255.225.0 (a standard Class C Network with 254 Devices in a single Subnet).

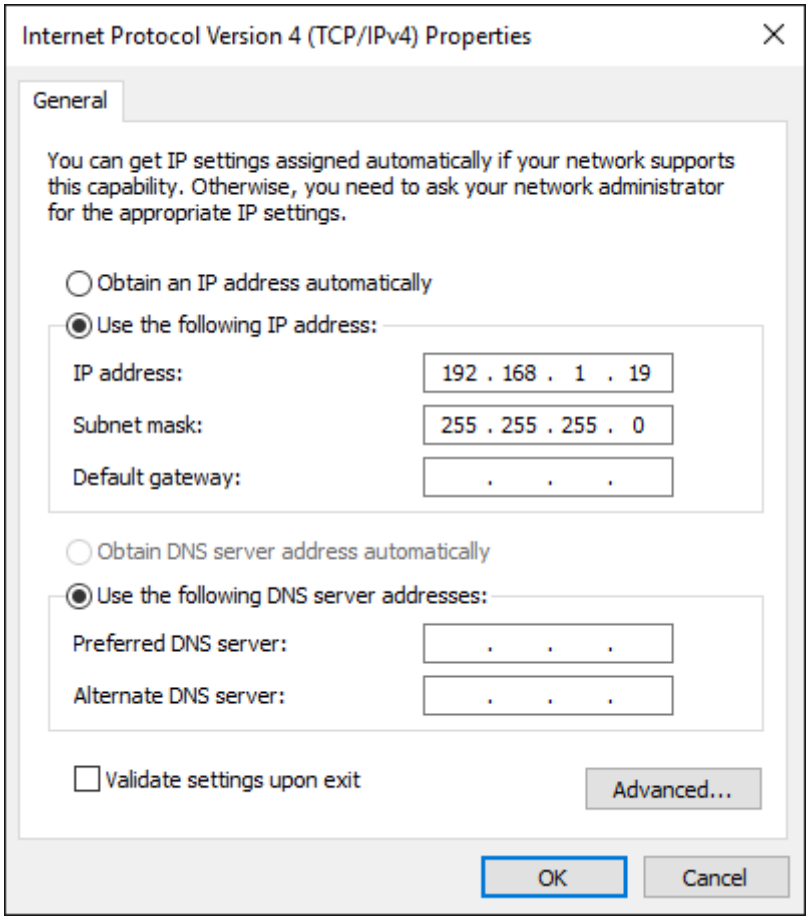
5. The Device will change its address and closes the connection. Now you can reach the webserver of the switch under 192.168.1.101 via a web browser.



4. Default Settings

Barox LT-802GBTME series factory default settings:
Default IP address: 192.168.1.254
Default subnet mask: 255.255.255.0
Default user name: admin
Default password: admin

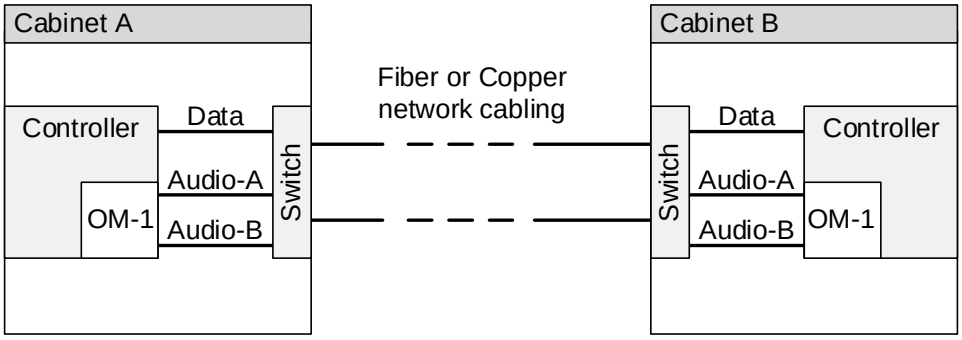
PC's network settings:
For the configuration of a new, unconfigured Barox LT-802GBTME switch, assign an IP address from the 192.168.1.1 to 192.168.1.253 range and subnet mask 255.255.255.0 to your PC's network interface.



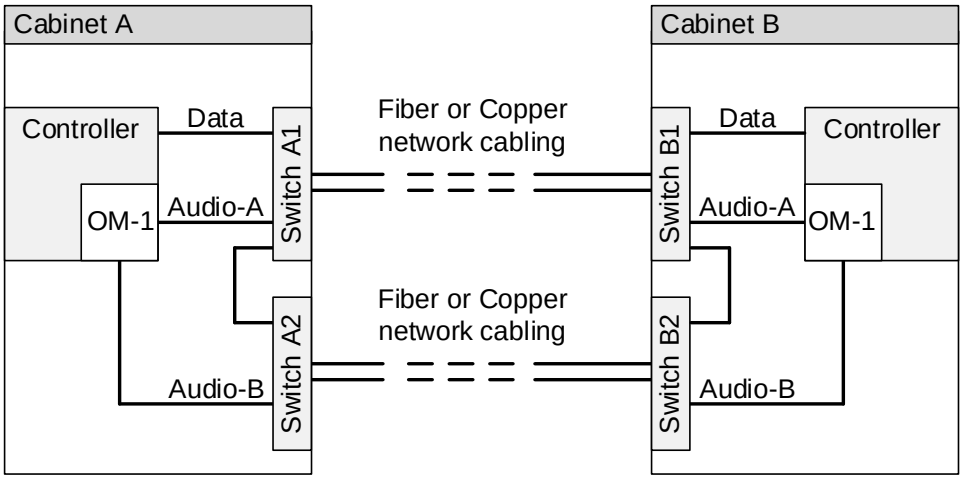
5. Redundant Network Setup

If redundant cabling between racks is required, there are three different ways to realize this:

Redundant network setup with RSTP configured switches (single ring)

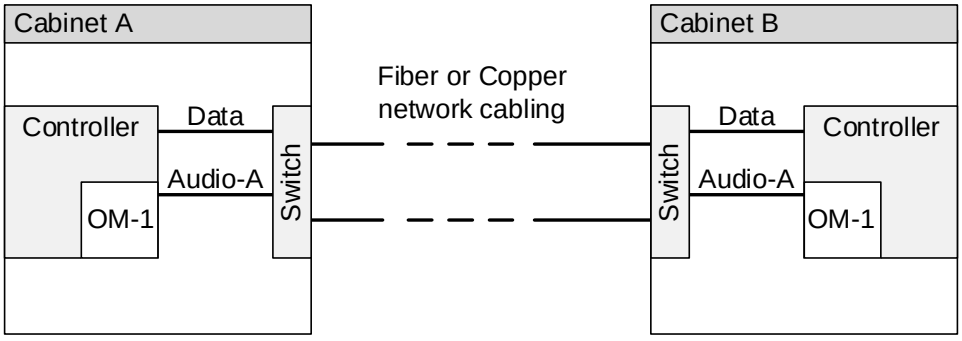


Redundant network setup with RSTP configured switches (double ring)



Notice!
If using a double ring, it is necessary to make a connection between the two rings in each cabinet.

Redundant network setup with ERPS configured switches (single ring)



6. Switch Specification

The switch for a PAVIRO system needs to fulfill the following specifications:

Feature	Standard	Description
1Gbit full duplex copper ports	IEEE802.3	Standard for Dante. Switch latency is maximal 10µs with 1 Gbit.
1Gbit full duplex fiber optic ports (SFP modules)	IEEE802.3	Needed for distances > 100m.
Switch has to be manageable (via web browser or at least by telnet/serial console)	n.a.	Switch needs to be configurable.
Energy Efficient Ethernet (EEE) deactivateable	IEEE 802.3az	Most implementations of EEE (also known as Green Ethernet) cause problems because of implementation flaws. A good implementation should work but does not save energy since the Precision Time Protocol (PTP) synchronization avoids this. Therefore it must be possible to disable EEE (this is not possible with unmanaged switches).
Wire speed switching	n.a.	If package switching is managed by software, variable latency can occur. This can cause network streaming problems which must be avoided.
Full Quality of Service (QoS) through differentiated services (DiffServ) on all Ports and on Backplane. QoS with a minimum of 4 queues and strict priority packet scheduling	DiffServ QoS	We recommend to use DiffServ (DSCP) QoS with priorities for 4 queues. Quality of Service (QoS) enables for prioritizing the transfer of specific data. Configuring the QoS as recommended by Dante on a network switch, give Dante clock synchronization (PTP) top priority and give audio data the next highest priority over background data traffic. This will ensure Dante audio streaming performance, when control data over the same network is transferred. This ensures that control data still goes through when transferring massive amounts of audio data.
Rapid Spanning Tree (RSTP) support	IEEE802.1d-2004	To allow the creation of loops for redundancy (e.g. ring topology).
Fault contact	EN54-16	Required for link and switch supervision.
Redundant power supply option	n.a.	Minimum requirement is one 24V DC input (redundancy is ensured via the backup power supply / charger of the PAVIRO system).
MAC table >1000	n.a.	Recommended to avoid the switch starts broadcasting unicast packets because it runs out of space.
Simple Network Management Protocol (SNMP) support (optional)	SNMPv3 (RFC 3410)	Recommended for network diagnoses (e.g. Docent software).
Link Layer Discovery Protocol (LLDP) support (optional)	IEEE 802.1AB	Recommended for network diagnoses (e.g. Docent software).
VLAN support (optional)	IEEE 802.1Q (tagged) or port based	Recommended for non EN54-16 systems to separate PAVIRO data from other traffic.

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