GPEN21 series Manual

Summary

The GPEN21 is a smart power injector that serves as an advanced software-controlled repeater. Not only can it power your uplink devices via PoE, but it can also provide a range of useful software features. GPEN21 has an Ethernet and SFP port for fiber connectivity. Customers can choose to use GPEN21 to power optical module for uplink to the provider, or to provide PoE to power Ethernet uplink to the provider (that uses our GPeR and/or netPower products). The GPEN21 unit can be securely attached to a wall or the communications cabinet. The Ethernet cable can be routed either directly through its bottom cable opening or into the wall, as preferred.

SwOS Lite is an operating system designed specifically for the administration of MikroTik GPEN21 products. GPEN21 support only SwOS Lite operating system.

GPEN21 series features

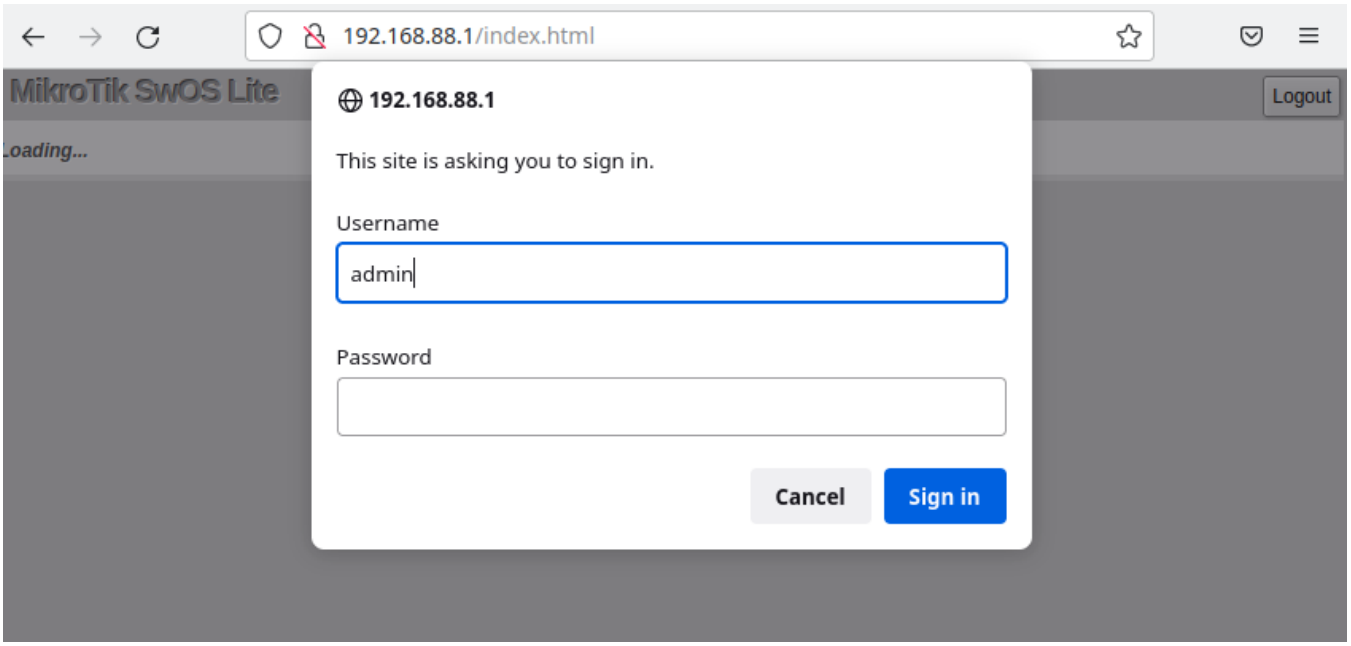
Features	Description
Forwarding	• Full non-blocking wirespeed switching • Up to 2k MAC entries in the Host table [1] • Forwarding Database works based only on SVL • Jumbo frame support - 10222 bytes
Monitoring	• SNMP • Link fault detection • SFP diagnostics • Interface statistics
VLAN	• Fully compatible with IEEE802.1Q • Port-based VLAN • Up to 250 VLAN entries (limited by SwOS) • VLAN filtering
Security	• Port Lock • Broadcast Storm Control

Quality of Service (QoS)	• Ingress traffic limiting • Egress traffic limiting
Access Control List	• Ingress ACL tables • Up to 32 ACL rules (limited by SwOS) • Classification based on ports, L2, L3, L4 protocol header fields • ACL actions include filtering, forwarding, and modifying the protocol header fields

[1] The Host table limit does not affect forwarding because packets are sent from upstream to downstream ports and vice versa even when the MAC learning limit is reached.

Connecting to the Device

Open your web browser and enter the IP address of your device (192.168.88.1 by default) and a login screen will appear. The device can also run a DHCP client, see if a different IP address has been assigned by the DHCP server.



SwOS default IP address: **192.168.88.1**, user name: **admin** and there is no password.

MikroTik Neighbor Discovery can be used to discover the IP address of the device. LLDP is not supported.

Interface Overview

SwOS interface menu consists of multiple tabs depending on the device model. These are all possible SwOS menus: Link, SFP, Forwarding, Stats, Errors, Hist, VLAN, VLANs, Hosts, SNMP, ACL, System, and Upgrade.

Description of buttons in SwOS configuration tool:

- **Append** - add a new item to the end of the list
- **Apply All** - applies current configuration changes
- **Cut** - removes an item from the list
- **Clear** - reset properties of the item
- **Discard Changes** - removes unsaved configuration

- **Insert** - add a new item to the list (places it before current item)
- **Sort** - sort VLAN table by VLAN-IDs; sort host table by MAC addresses
- **Change Password** - changes the password of the device
- **Logout** - logout from the current device
- **Reboot** - reboot the device
- **Reset Configuration** - reset configuration back to factory defaults
- **Choose File** - browse for upgrade or backup file
- **Upgrade** - upgrade the firmware of the device using the selected file
- **Download & Upgrade** - automatically try to download and upgrade the firmware, the PC which is running a web browser should be able to access the Internet
- **Restore Backup** - restore device using a selected backup file
- **Save Backup** - generate and download the backup file from the device

Each device has its own firmware which cannot be installed on other series models!

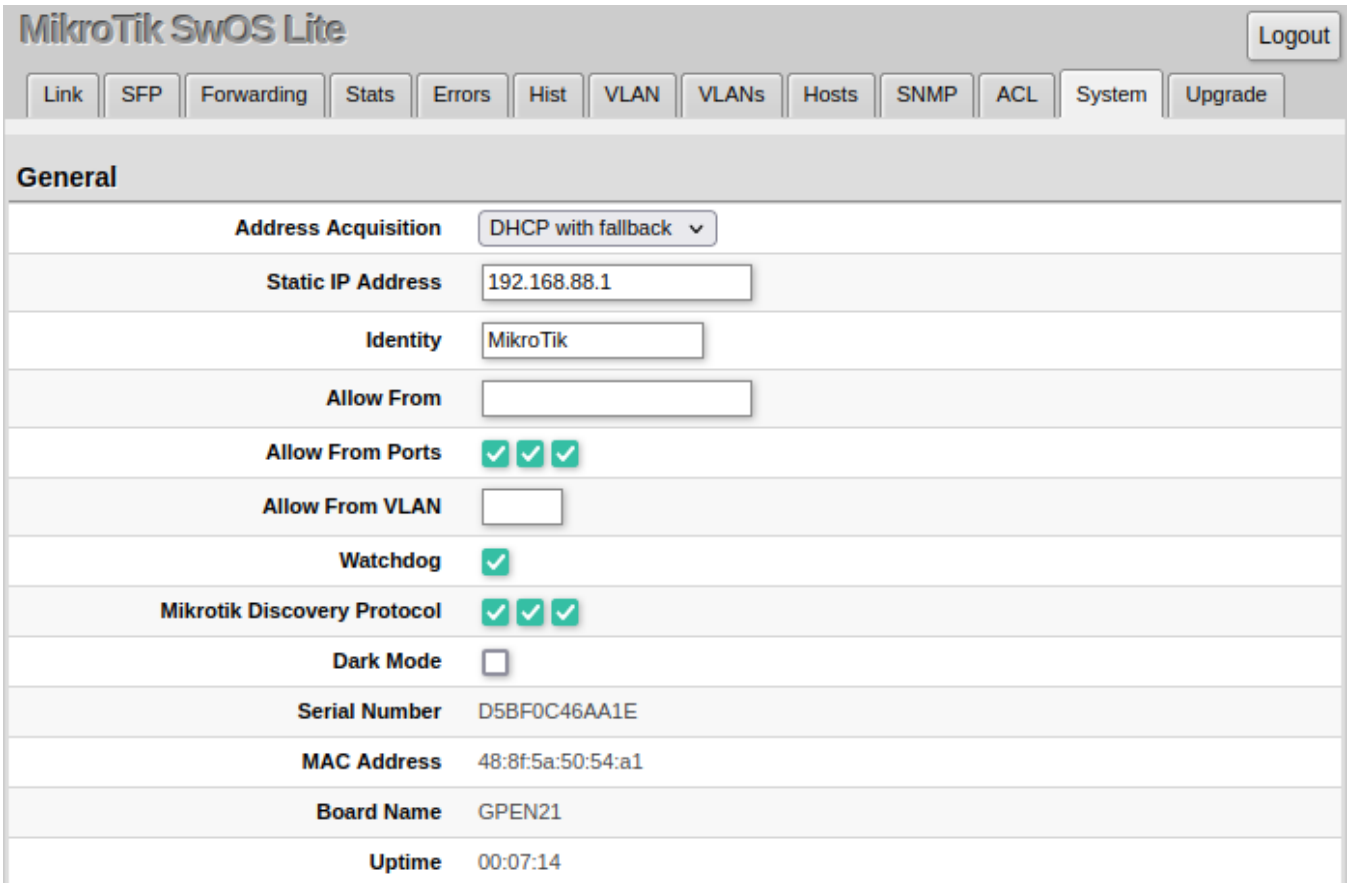
- GPEN21 supports SwOS Lite v2.13 and newer.

System

System Tab performs the following functions:

- General information about the device
- Device management
- Configuration reset
- Backup and restore configuration

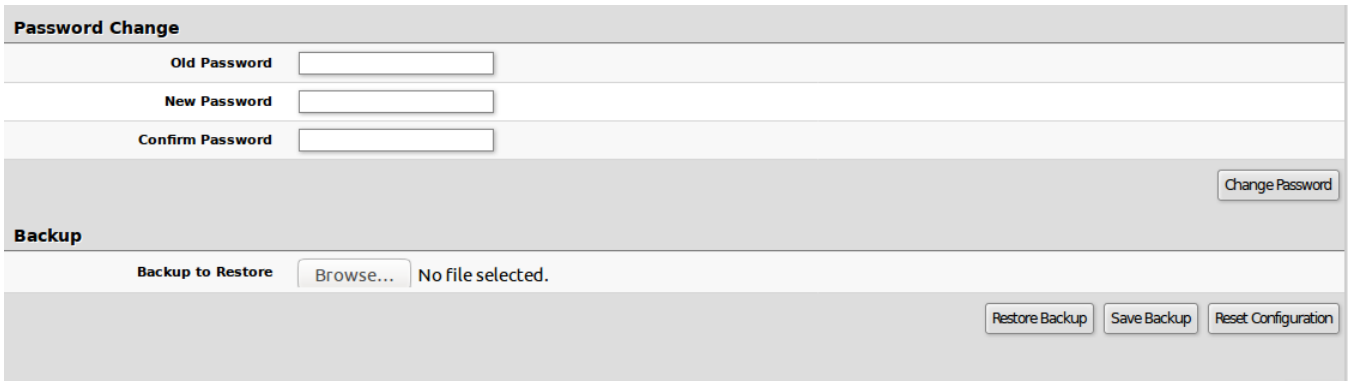
SwOS uses a simple algorithm to ensure TCP/IP communication - it just replies to the same IP and MAC address packet came from. This way there is no need for Default Gateway on the device itself.



Property	Description
Address Acquisition	Specify which address acquisition method to use: • **`DHCP with fallback`** - device is trying to request an IP address from a DHCP server. If the requests are unsuccessful, then the device can be accessed using a **Static IP Address** value • **`static`** - address is set as a **Static IP Address** value • **`DHCP only`** - device uses DHCP client to acquire address
Static IP Address	IP address of the device in case of **Address Acquisition** is set as **`DHCP with fallback`** or **`static`**
Identity	Name of the device (for Mikrotik Neighbor Discovery protocol)
Allow From	IP address from which the device is accessible. Default value is '0.0.0.0/0' - any address
Allow From Ports	List of device ports from which it is accessible
Allow From VLAN	VLAN ID from which the service is accessible. Make sure to first configure VLANs and VLAN pages
Watchdog	Enable or disable system Watchdog. It will reset the CPU of the device in case of a fault condition
Mikrotik Discovery Protocol	Enable or disable Mikrotik Neighbor Discovery protocol
Dark Mode	Disable or enable all LEDs on the device
MAC Address	MAC address of the device (read-only)
Serial Number	Serial number of the device (read-only)
Board Name	MikroTik model name of the device (read-only)
Uptime	Current device uptime (read-only)

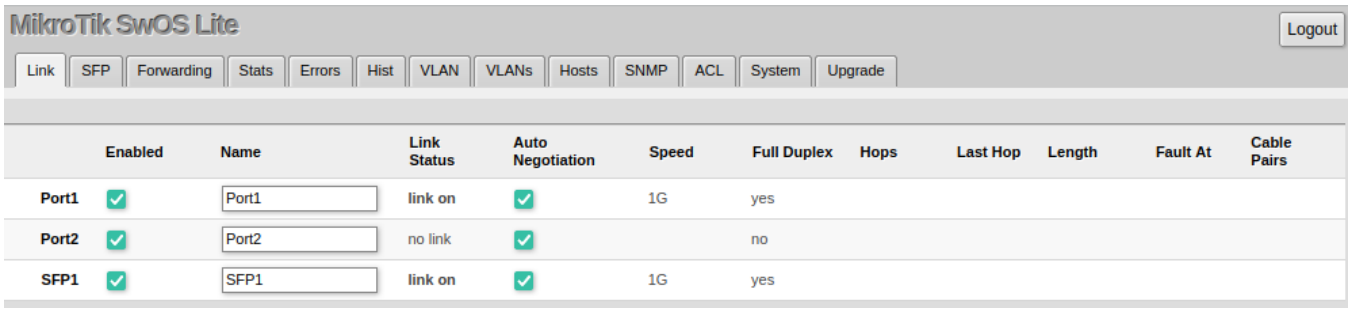
PoE Out Mode	Specifies PoE-Out state: • auto-on - the board will attempt to detect if power can be applied to the port. For power-on to happen there should be resistance on spare pairs in the range from 3kΩ to 26.5kΩ • forced-on - detection range is removed. As a result power over Ethernet will be always on • off - all detection and power is turned off for this port
PoE Out Status	Shows current PoE-Out status on port (read-only)

Password and Backup



Link

Link Tab allows you to configure each interface settings and monitor the link status.



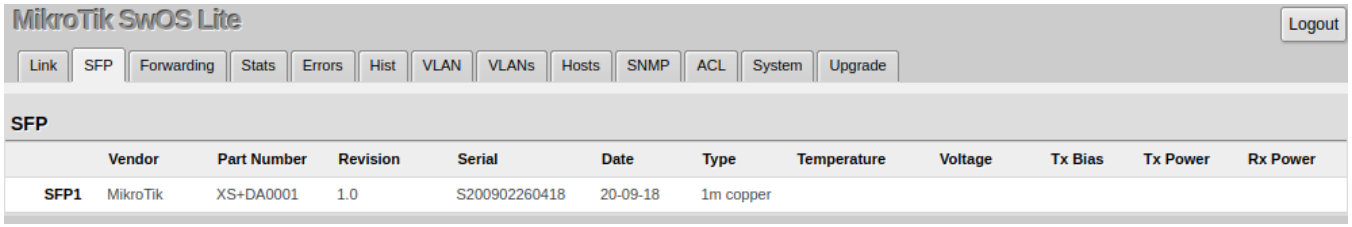
Property	Description
Enabled	Enable or disable port
Name	Editable port name
Link Status	Current link status (read-only)
Auto Negotiation	Enable or disable auto-negotiation
Speed	Shows the negotiated speed, or allows manually changing the speed setting of the port (requires auto-negotiation to be disabled)
Full Duplex	Shows the negotiated duplex, or allows manually changing the duplex mode of the port (requires auto-negotiation to be disabled)
Hops	Shows the number of GPER repeaters in the link
Last Hop	Shows the number of the last GPER repeater if the link is terminated
Length	Shows the length of the cable in meters if the link is terminated
Fault At	Shows the distance in meters to the failure point if the cable is damaged but the link is active

Cable Pairs	Shows four positions of the cable pairs with their status: O - open; S - short; P - reverse polarity

The device supports Jumbo frames up to 10222 bytes. Manually decreasing the MTU settings is not supported for SwOS Lite devices.

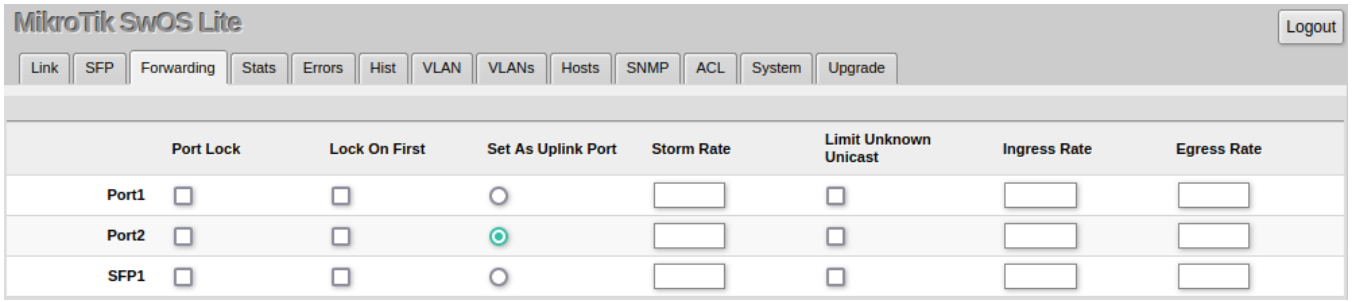
SFP

The SFP tab allows you to monitor the status of SFP modules.



Forwarding

Forwarding Tab provides advanced forwarding options among device ports, port locking, bandwidth limit, and broadcast storm control features.

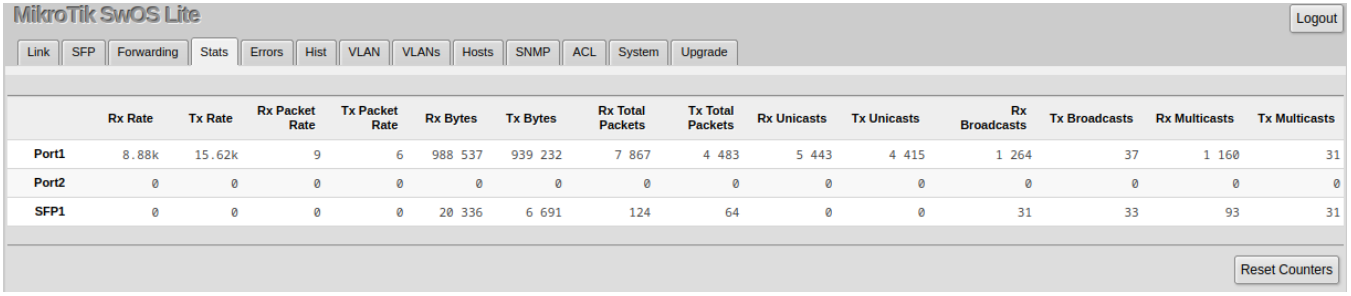


Property	Description
Port Lock	• **`Port Lock`** - Enables or disables MAC address learning on this port. When the option is enabled, it will restrict MAC address learning and static MAC addresses should be configured. Any received frames with an unknown source MAC address will be dropped. • **`Lock On First`** - Allows to learn source MAC address from the first received frame, this property should be used together with **`Port Lock`**. Learning of the first MAC address will reset every time an interface status changes.
Uplink Port	• **Set As Uplink Port** - Allows changing the uplink port between PoE-in (Port1), PoE-out (Port2), or SFP interfaces. Packets received on downstream ports are forwarded only to the uplink port, only a single interface can be used as an uplink.
Broadcast Storm Control	• **`Storm Rate`** - Limit the number of broadcast packets transmitted by an interface. The rate is measured in bits per second (bps). • **`Limit Unknown Unicast`** - Include unicast packets without an entry in the host table in `Storm Rate` limitation.
Bandwidth Limit	• **`Ingress Rate`** - Limit traffic entering this port (bps) • **`Egress Rate`** - Limit traffic leaving this port (bps)

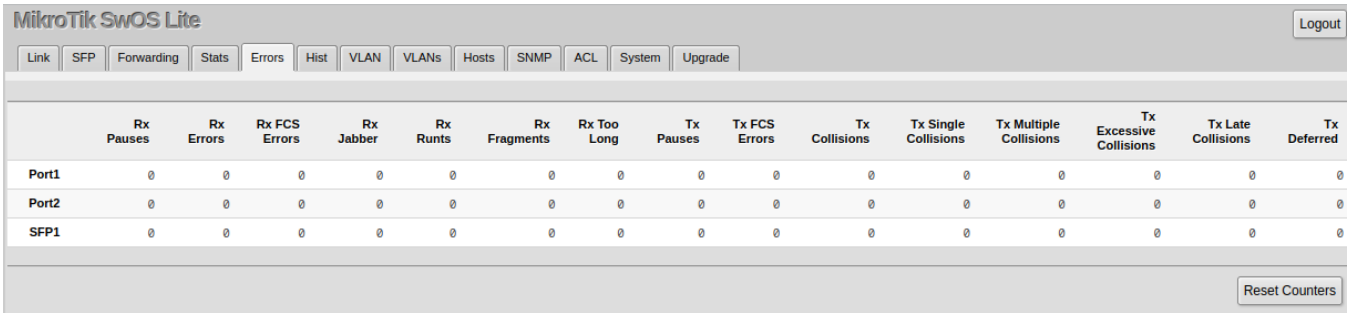
It is possible to limit ingress/egress traffic per port basis. The policer is used for ingress traffic, the shaper is used for egress traffic. The ingress policer controls the received traffic with packet drops. Everything that exceeds the defined limit will get dropped. This can affect the TCP congestion control mechanism on end hosts and achieved bandwidth can be actually less than defined. The egress shaper tries to queue packets that exceed the limit instead of dropping them. Eventually, it will also drop packets when the output queue gets full, however, it should allow utilizing the defined throughput better.

Stats, Errors and Histogram

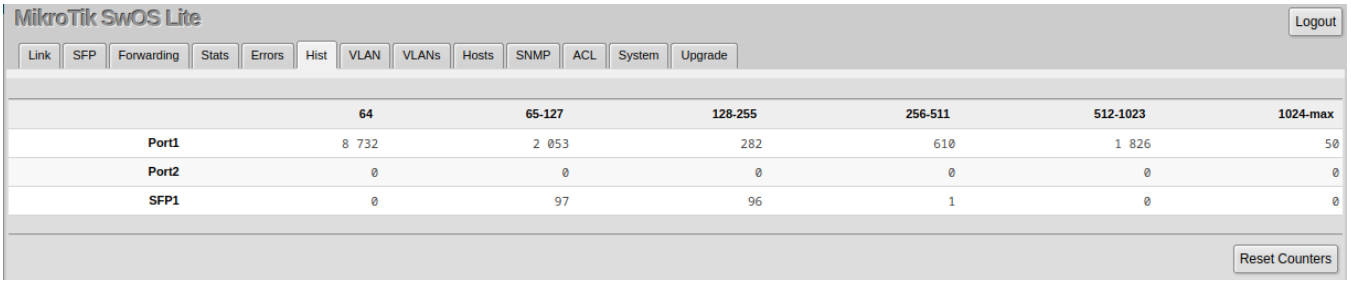
These menus provide detailed information about received and transmitted packets.



	Rx Rate	Tx Rate	Rx Packet Rate	Tx Packet Rate	Rx Bytes	Tx Bytes	Rx Total Packets	Tx Total Packets	Rx Unicasts	Tx Unicasts	Rx Broadcasts	Tx Broadcasts	Rx Multicasts	Tx Multicasts
Port1	8.88k	15.62k	9	6	988 537	939 232	7 867	4 483	5 443	4 415	1 264	37	1 160	31
Port2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SFP1	0	0	0	0	20 336	6 691	124	64	0	0	31	33	93	31



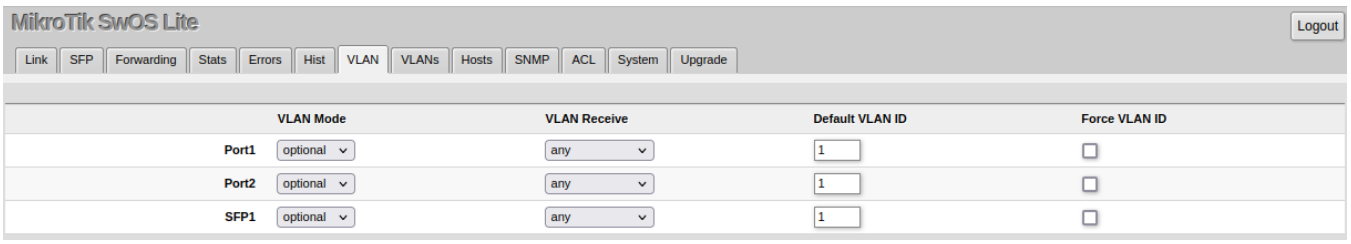
	Rx Pauses	Rx Errors	Rx FCS Errors	Rx Jabber	Rx Runts	Rx Fragments	Rx Too Long	Tx Pauses	Tx FCS Errors	Tx Collisions	Tx Single Collisions	Tx Multiple Collisions	Tx Excessive Collisions	Tx Late Collisions	Tx Deferred
Port1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SFP1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



	64	65-127	128-255	256-511	512-1023	1024-max
Port1	8 732	2 053	282	610	1 826	50
Port2	0	0	0	0	0	0
SFP1	0	97	96	1	0	0

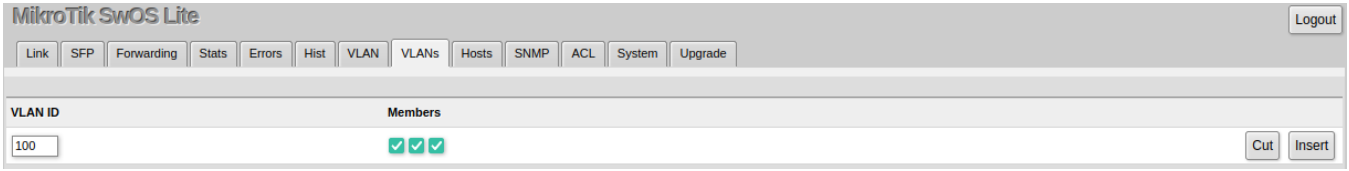
VLAN and VLANs

VLAN configuration for device ports.



Property	Description
VLAN Mode (*disabled | optional | strict*; Default: **optional**)	VLAN filtering mode, these options are relevant to egress ports (except for strict mode). • disabled - VLAN table is not used. The device discards packets with a VLAN tag on egress ports. If the packet has a VLAN tag and the VLAN ID matches `Default VLAN ID` on egress ports, then with `VLAN Receive=any` the device will remove the VLAN tag and forward the packet. • optional - Disabled VLAN filtering. Handle packets with VLAN tag ID that is not present in the VLAN table just like packets without VLAN tag. • strict - Enabled VLAN filtering with additional ingress filtering, which checks if the ingress port is a member of the received VLAN ID in the VLAN table. Received packets on the ingress port with a VLAN ID that does not match with the VLAN table will be dropped. Default VLAN ID must be specified for access ports since it will be used to tag ingress traffic and untag egress traffic for a certain port.
VLAN Receive (*any | only tagged | only untagged*; Default: **optional**)	**Received** traffic filtering based on VLAN tag presence. • any - allows tagged and untagged packets on a certain port • only tagged - allows only packets with a VLAN tag. The "Default VLAN ID" will not work, because it only applies for untagged traffic • only untagged - Allows only packets without a VLAN tag
Default VLAN ID (*integer: 1..4095*; Default: **1**)	The device will place received untagged packets in the "Default VLAN ID" VLAN. Only has an effect on untagged traffic, and when **VLAN Receive** is set to "any" or "only untagged". It does not apply for tagged traffic. This parameter is usually used to allocate access ports with specific VLAN. It is also used to untag egress traffic if the packet's VLAN ID matches Default VLAN ID.
Force VLAN ID (*integer: yes | no*; Default: **no**)	Assigns the `Default VLAN ID` value to all ingress traffic (tagged and untagged). Has effect in all VLAN Modes. If the port receives tagged traffic and `Default VLAN ID` is set to 1, then with this parameter the egress traffic will be untagged.

VLAN membership configuration for device ports.

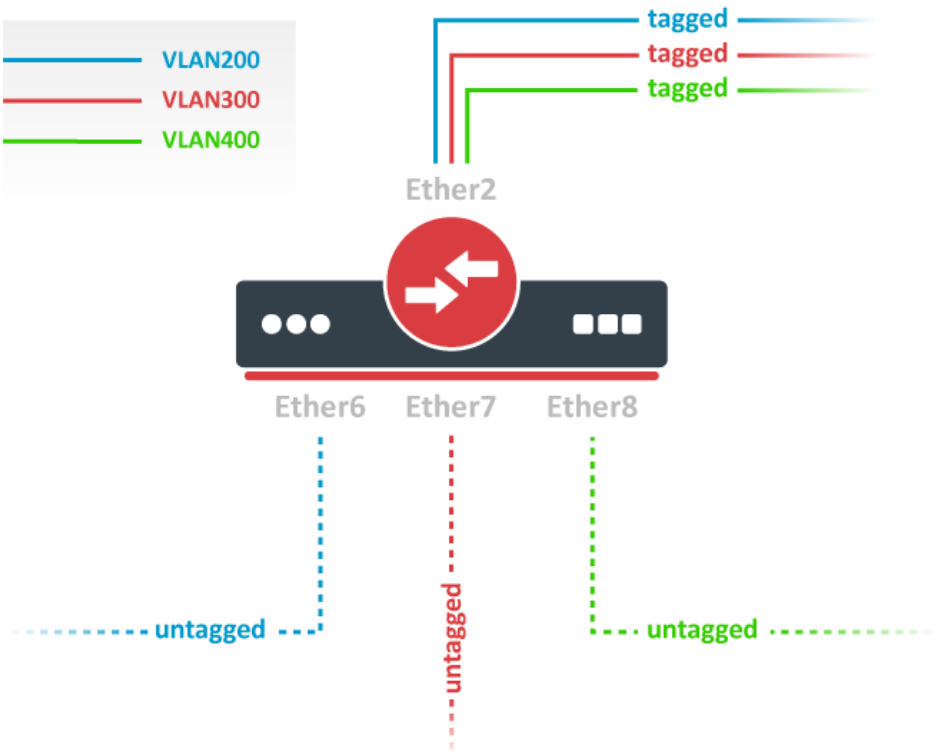


Property	Description
VLAN ID (*integer: 1..4094*; Default: **0**)	VLAN ID to which assign ports.
Members (*ports*; Default: **none**)	Group of ports, which are allowed to forward traffic on the defined VLAN.

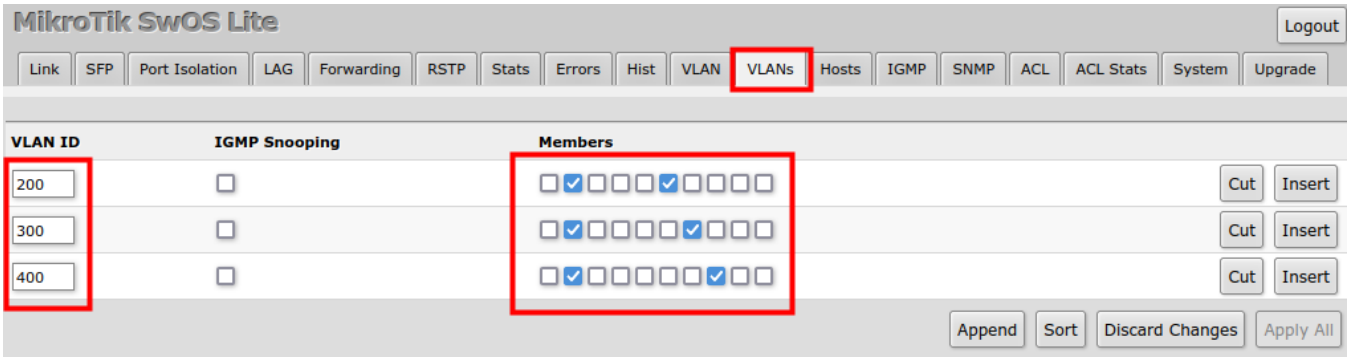
VLAN Configuration Example

⚠ The VLAN configuration examples are taken from the CSS610 switch user manual, however, the same principles can be applied to the GPEN21 device.

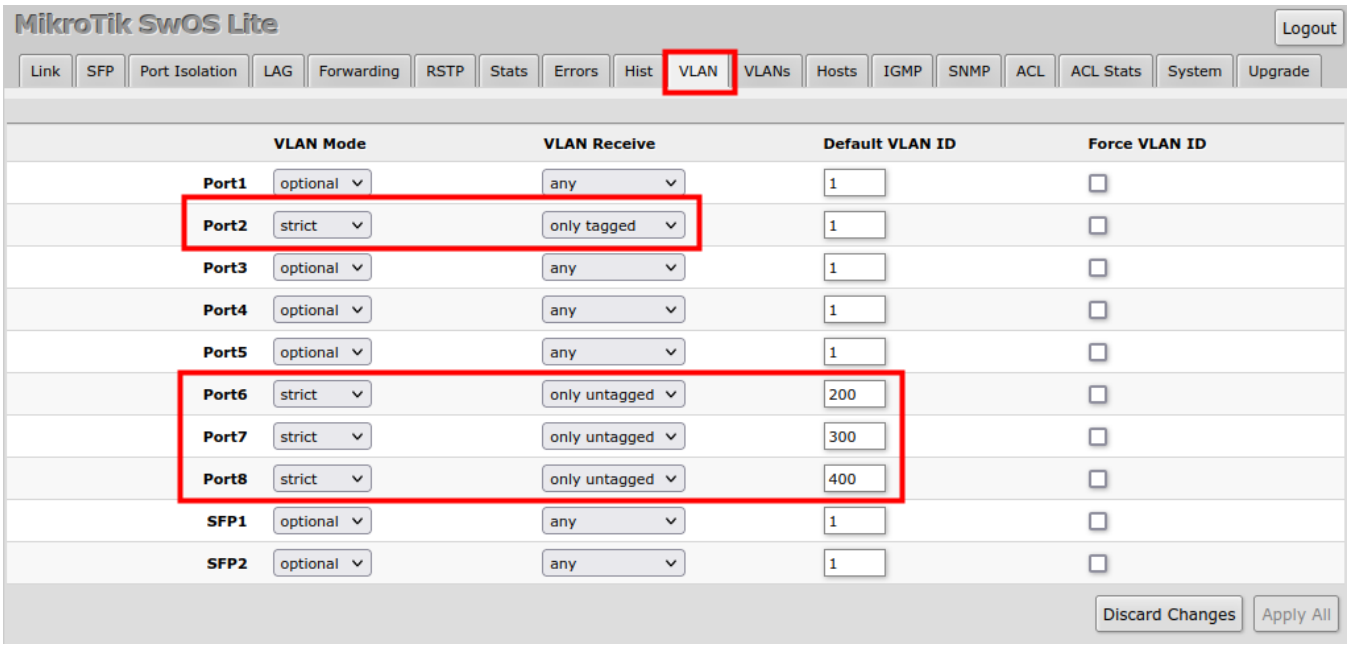
Trunk and Access Ports



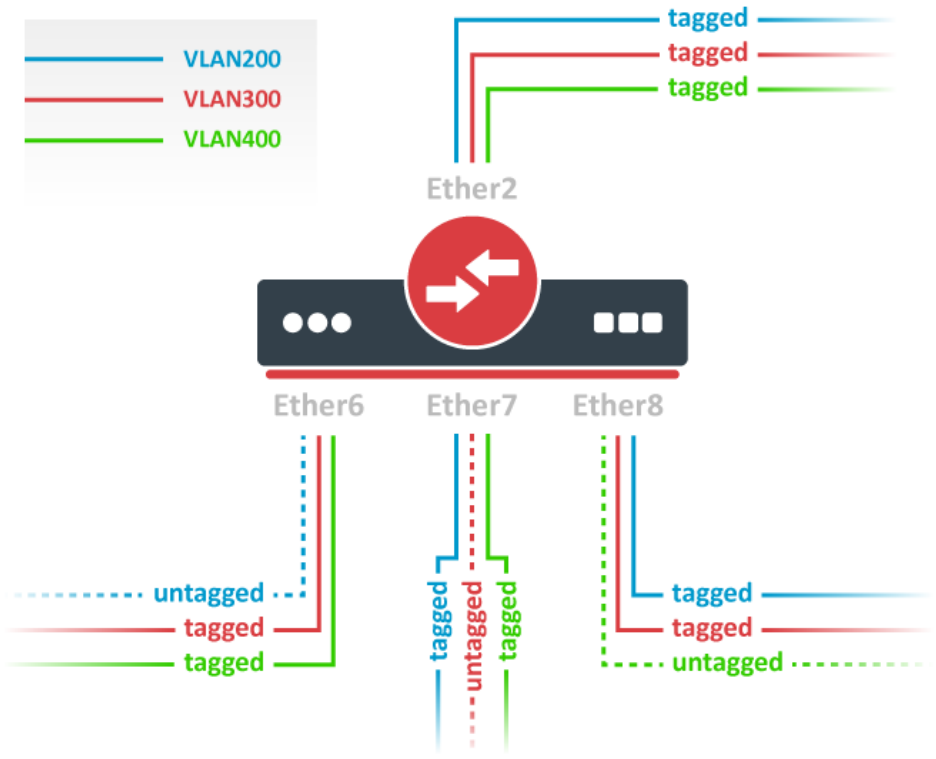
1. In the VLANs menu add VLAN entries and specify port membership.



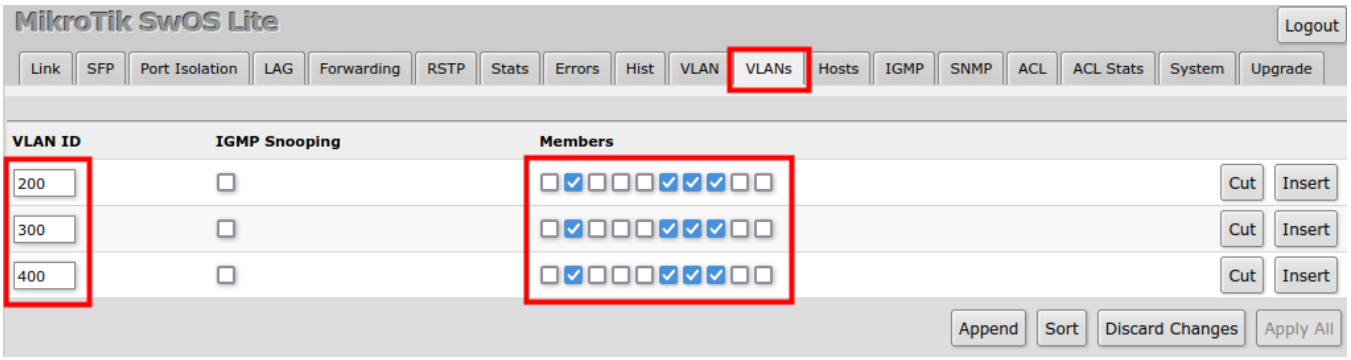
2. In the VLAN menu configure Default VLAN ID on planned access ports (untagged), select the correct VLAN Receive setting (Port2 only tagged, Port6-8 only untagged) and enable strict VLAN filtering to ensure only allowed VLANs can pass through the ports.



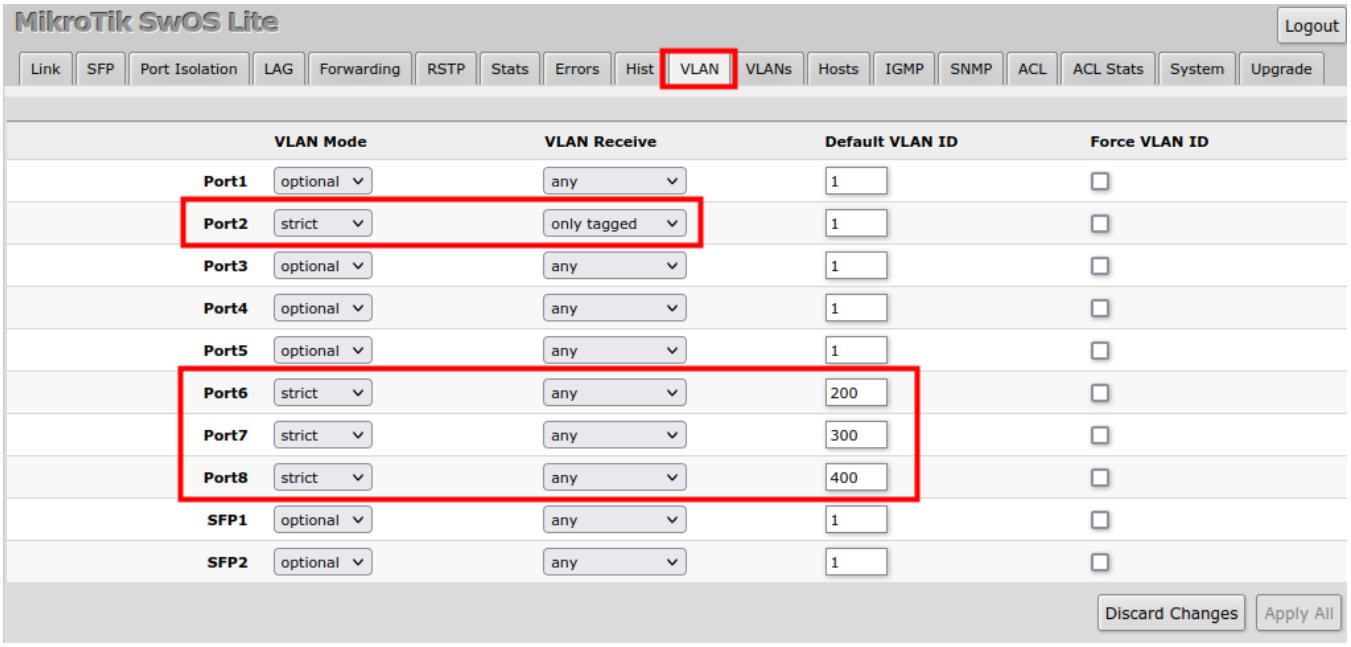
Trunk and Hybrid Ports



1. In the VLANs menu add VLAN entries and specify port membership.

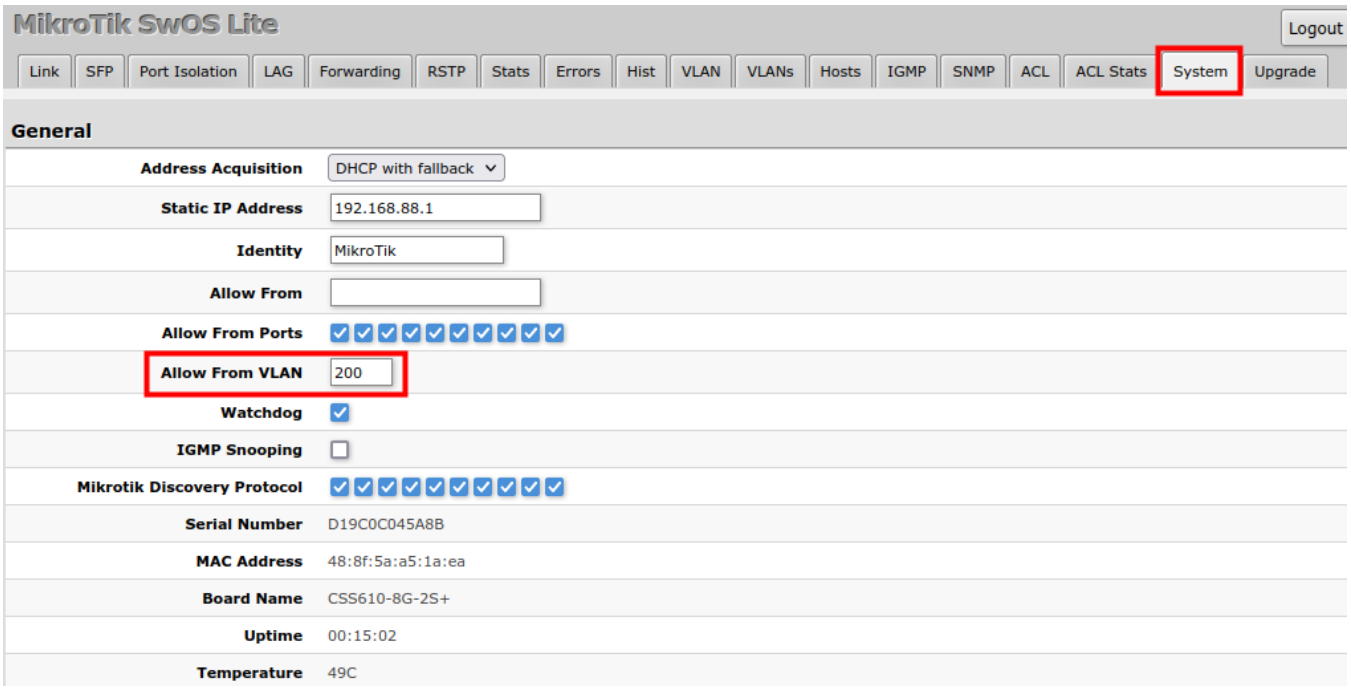


2. In the VLAN menu configure Default VLAN ID on planned hybrid ports (for untagged VLAN), select the correct VLAN Receive setting (Port2 only tagged, Port6-8 any) and enable strict VLAN filtering to ensure only allowed VLANs can pass through the ports.



Management access

In this example, device management access on VLAN 200 will be created. The configuration scheme is the same as "**Trunk and Access Ports**" and **1., 2.** co nfiguration steps are identical. The additional **3rd** step requires specifying the management VLAN ID in the System menu. After applying the configuration, the device will only respond to tagged VLAN 200 packets on Port2 and untagged packets on Port6. The DHCP client will also work in the specified VLAN ID.

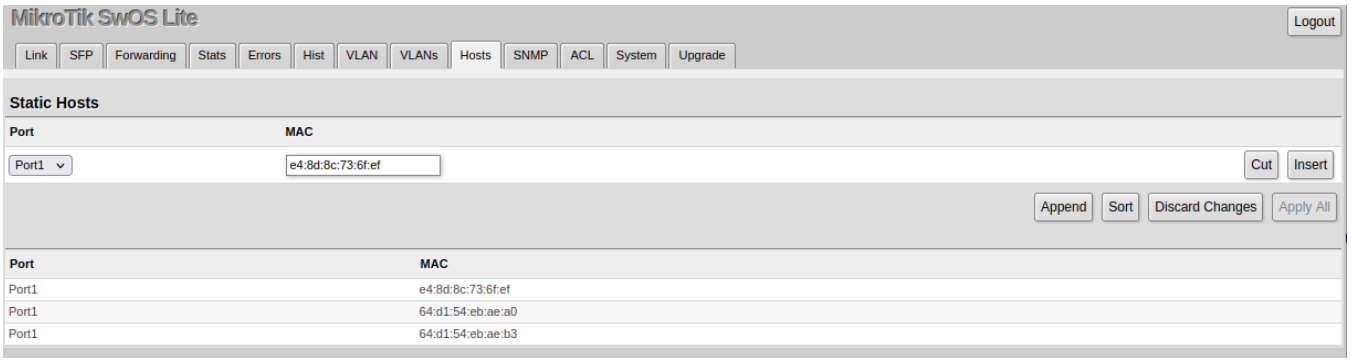


⚠ Changing management VLAN can completely disable access to the device management if VLAN settings are not correctly configured. Save a configuration backup before changing this setting and use Reset in case management access is lost.

Hosts

This table represents dynamically learned MAC address to port mapping entries. It can contain two kinds of entries: dynamic and static. Dynamic entries get added automatically, this is also called a learning process: when a device receives a packet from a certain port, it adds the packet's source MAC address and port it received the packet from to the host table, so when a packet comes in with a certain destination MAC address it knows to which port it should forward the packet. If the destination MAC address is not present in the host table then it forwards the packet to all ports in the group. Dynamic entries take about 5 minutes to time out.

Static entries will take over dynamic if dynamic entry with the same mac-address already exists. Also by adding a static entry you get access to more functionality.



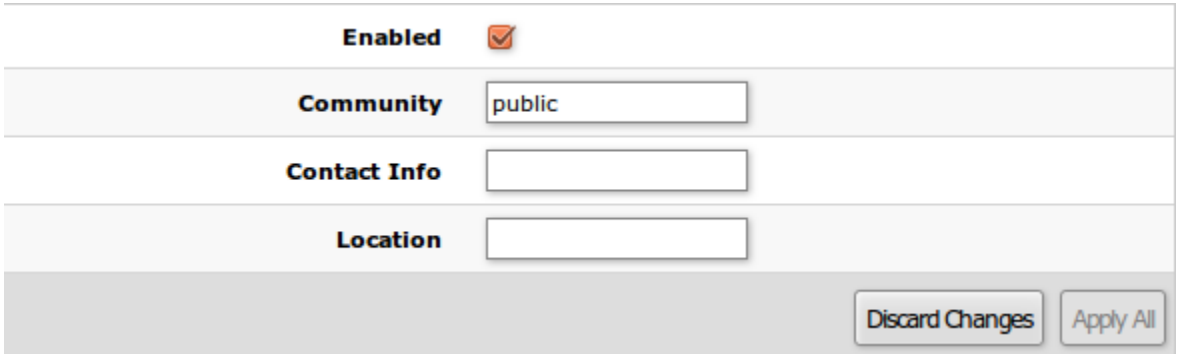
Property	Description
Ports	Ports the packet should be forwarded to
MAC	MAC address
Port *(read-only)*	Ports the packet should be forwarded to
MAC *(read-only)*	Learned MAC address

SNMP

SwOS supports SNMP v1 and v2c (the Response for GetRequest, GetNextRequest and GetBulkRequest) and uses IF-MIB, SNMPv2-MIB, BRIDGE-MIB and MIKROTIK-MIB (only for health, PoE-out and SFP diagnostics). SNMP traps and writing SwOS configuration are not supported.

Available SNMP data:

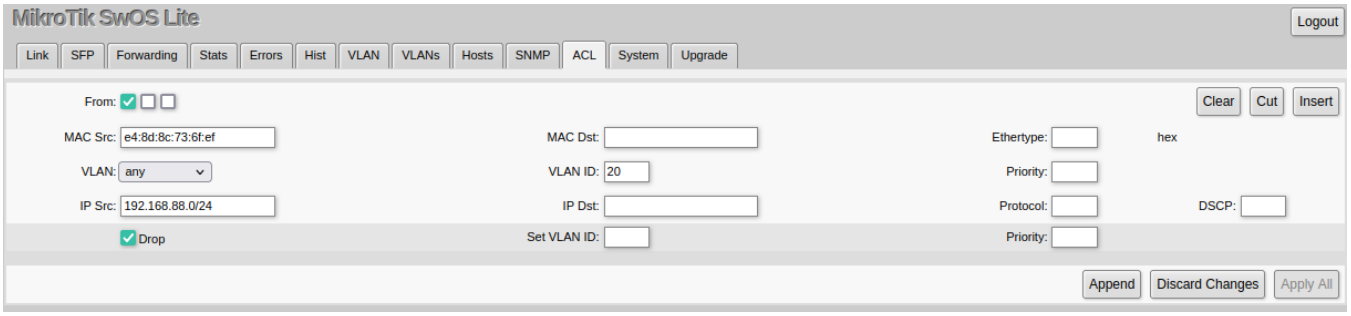
- System information
- System uptime
- Port status
- Interface statistics
- Host table information



Property	Description
Enabled	Enable or disable SNMP service
Community	SNMP community name
Contact Info	Contact information for the NMS
Location	Location information for the NMS

ACL

An access control list (ACL) rule table is a very powerful tool allowing wire-speed packet filtering, forwarding, and VLAN tagging based on L2,L3, and L4 protocol header field conditions. Each rule contains a conditions part and an action part.



Conditions part parameters

Property	Description
From	A port that packet came in from
MAC Src	Source MAC address and mask

MAC Dst	Destination MAC address and mask
Ethertype	Protocol encapsulated in the payload of an Ethernet Frame
VLAN	VLAN header presence: • any • present • not present
VLAN ID	VLAN tag ID
Priority	Priority in VLAN tag
IP Src (IP/netmask:port)	Source IPv4 address, netmask, and L4 port number
IP Dst (IP/netmask:port)	Destination IPv4 address, netmask, and L4 port number
Protocol *(integer)*	IP protocol
DSCP	IP DSCP field

Action part parameters

Property	Description
Drop	Drop packet
Set VLAN ID	Changes the VLAN tag ID, if the VLAN tag is present
Priority	Changes the VLAN tag priority bits, if the VLAN tag is present

Reset and Reinstall

The GPEN21 has built-in backup SwOS firmware which can be loaded in case standard firmware breaks or an upgrade fails:

- Holding the Reset button for a few seconds while the device is booting will reset the configuration and load backup firmware. The reset button is located behind the front cover.
- After loading backup firmware, it is possible to connect to 192.168.88.1 (or leased address from a DHCP server) using a web browser and install new SwOS firmware.