WM-E LCB®

Load Control Box

User Manual

v1.00

2022-05-02

WM Systems LLC 8 Villa str., Budapest H-1222 HUNGARY
Phone: +36 1 310 7075
Email: sales@wmsystems.hu Web: www.wmsystems.hu

Document specifications

This document was made for the **WM-E LCB® Load Control Box** device and it contains the detailed description of the configuration possibilities for the proper operation of the device.

Document category:	User Manual
Document subject:	WM-E LCB®
Author:	WM Systems LLC
Document version No.:	REV 1.00
Number of pages:	60
Hardware version:	BE0080B
Linux Kernel:	4.9.184
Bootloader version:	20180522
Microcontroller firmware:	20170914
OpenWRT software version:	202204281_RC
Document status:	FINAL
Last modified:	2 May, 2022
Approval date:	2 May, 2022

Table of contents

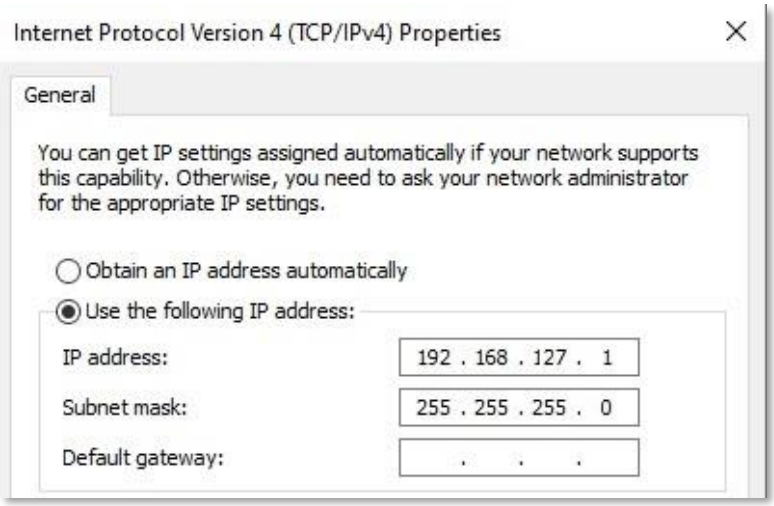
Chapter 1. Device configuration (OpenWrt user interface)

1.1 Web user interface

Important!

The device software contains a pre-configured system. Please check the configuration, and if the settings are not match with your expectations, change the configuration settings and save them.

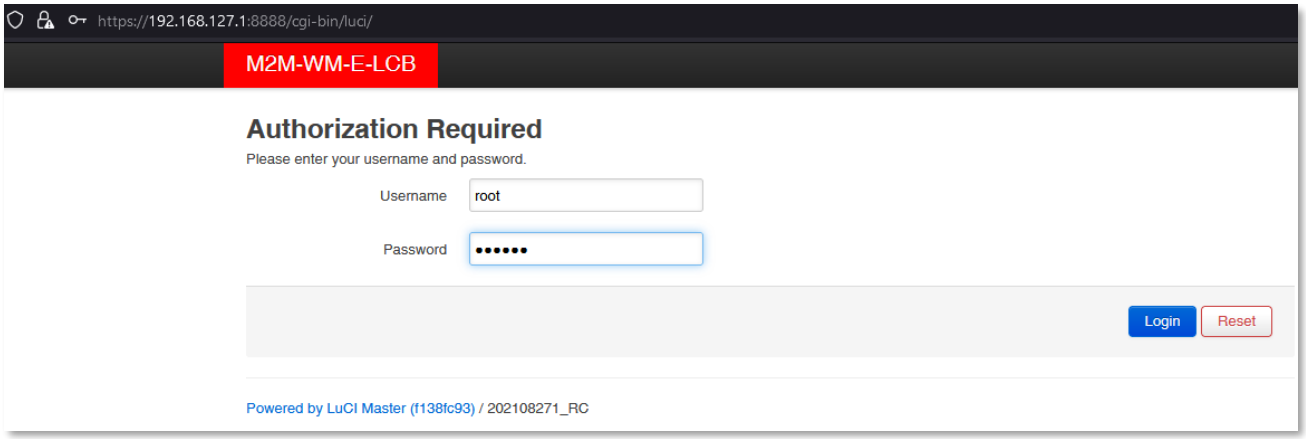
1. Configure the **Ethernet** interface's on your PC for TCP/IPv4 protocol for setup the **IP address:** 192.168.127.100 and **subnet mask**: 255.255.255.0



2. Start the device. The local web user interface (LuCi®) will be reachable after 1-2 minutes through the **Ethernet** (**LAN**) interface – on the device's default IP address in a web browser.

3. Open the device's local website in the **Mozilla Firefox** browser, where the default web user interface address on **Ethernet** port is: https://192.168.127.1:8888

   Login with the **Username**: *root* , **Password**: *wmrpwd* and push to the **Login** button.



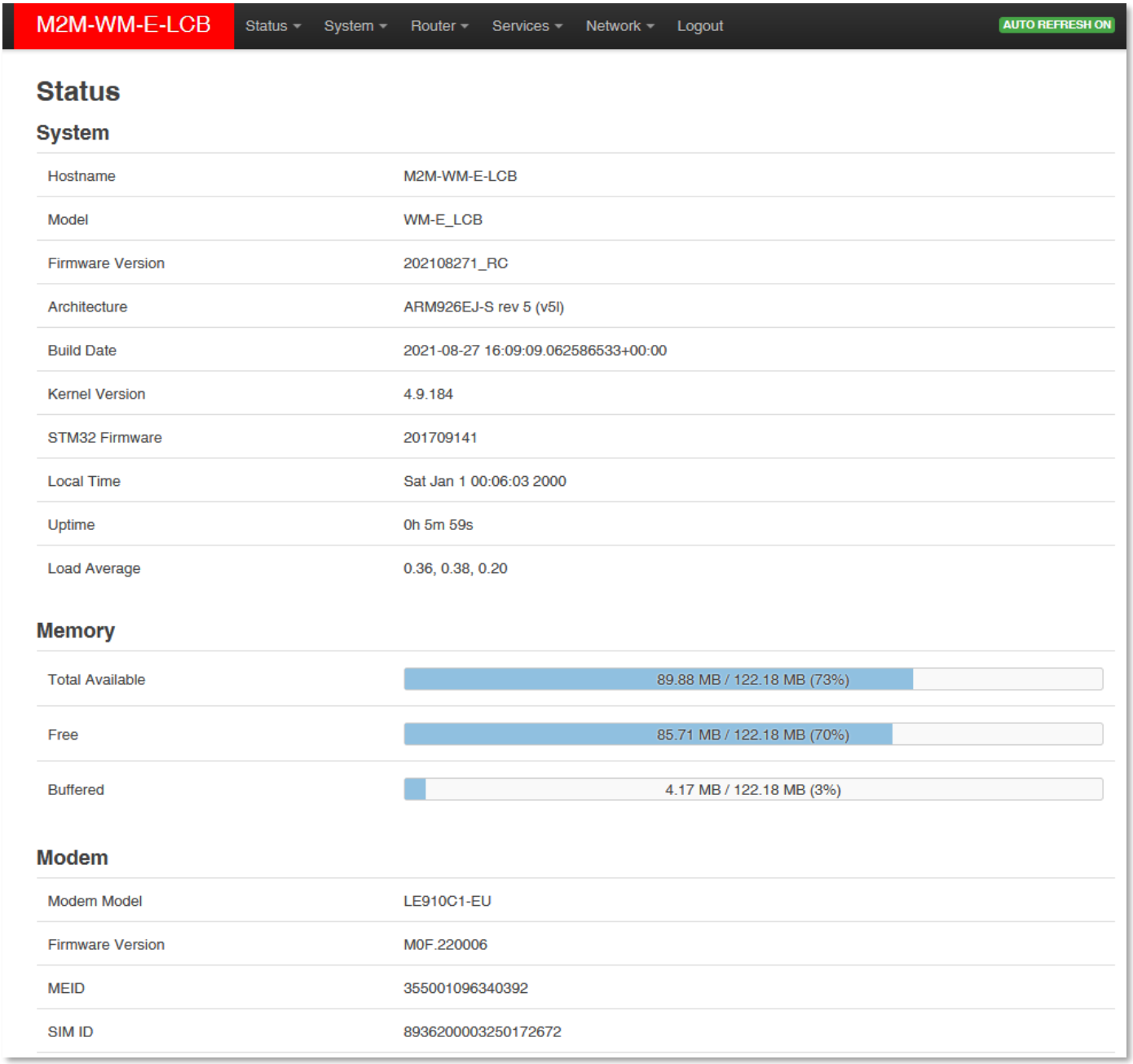
1.2 Dashboard (Main page)

After you have logged to the web interface, a startup screen appears with all relevant information and the current status of the device.

At the **System** part, you can check the installed software build (**Firmware Version**) where it should be ***202108271_RC*** or newer. (If it has an older version, then refresh the firmware, please.)

At the **Local Time** you can check the current time.

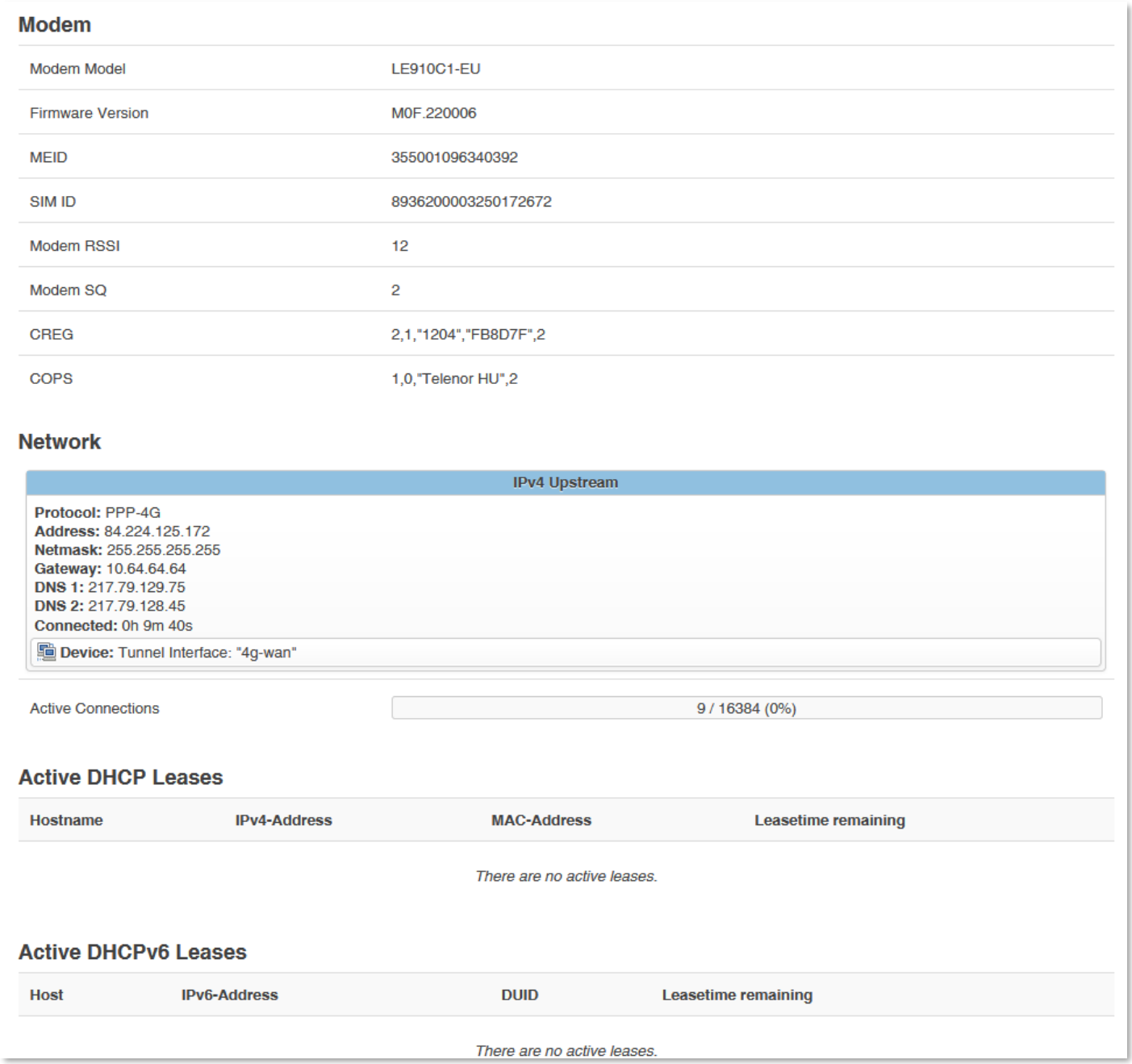
The **Uptime** shows the spent time interval since the last bootup (or reboot).



At the **Modem** part, first you can the module's **MEID** identifier (IMEI) and the **SIM ID** identifier of the used SIM card.

You can also check the wireless modem availability, current status and health at **Modem RSSI** (cellular network signal strength) and **Modem SQ. (**The lower RSSI means better cellular signal strength / higher SQ value means the better signal quality level).

At the **CREG** field you can get more info about the used cellular network cells. The **COPS** shows the connected network name.



Modem

Modem Model	LE910C1-EU
Firmware Version	M0F.220006
MEID	355001096340392
SIM ID	8936200003250172672
Modem RSSI	12
Modem SQ	2
CREG	2,1,"1204","FB8D7F",2
COPS	1,0,"Telenor HU",2

Network

IPv4 Upstream

Protocol: PPP-4G
Address: 84.224.125.172
Netmask: 255.255.255.255
Gateway: 10.64.64.64
DNS 1: 217.79.129.75
DNS 2: 217.79.128.45
Connected: 0h 9m 40s
Device: Tunnel Interface: "4g-wan"

Active Connections	9 / 16384 (0%)

Active DHCP Leases

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
There are no active leases.			

Active DHCPv6 Leases

Host	IPv6-Address	DUID	Leasetime remaining
There are no active leases.			

At the **Network** part, you can see the used cellular network IP address at the **Address field**.

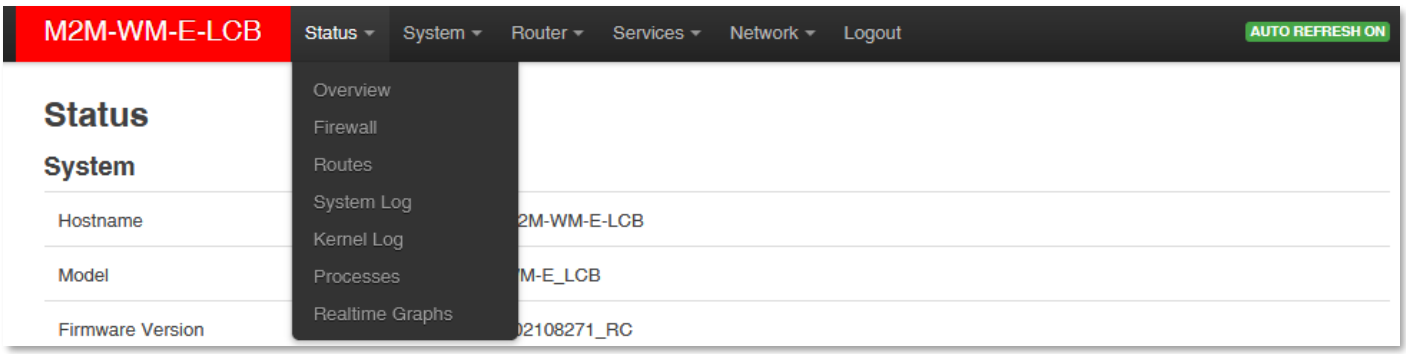
1.3 Menu overview

By the menu you can access the following features:

- **Status** – Status data, operation Logs (system, kernel, event log), Firewall monitoring, monitoring the operation (at *Processes* and *Realtime graphs*)
- **System** – System settings and administration (time sync, device name), software installation (3rd party tools), Startup settings and scheduled tasks, LED configuration, Firmware flashing, Backup/Restore of the configuration settings, Reboot of the system)
- **Router** – Device manager configuration, Modem settings and Logging parameters, Periodic ping and reboot, Factory configuration, Relay switch settings
- **Services** – Ser2net (RS485 configuration)
- **Network** – Network interface settings (for Ethernet and cellular module), DHCP, DynDNS, IP route/NAT, hostname, diagnostics, Firewall, IPSEC settings, voice call settings (remote reboot) and SMS configuration (remote command execution)
- **Statistics** – System graphs and statistics settings
- **Logout** – Logout and login with a different user

1.4 Status menu

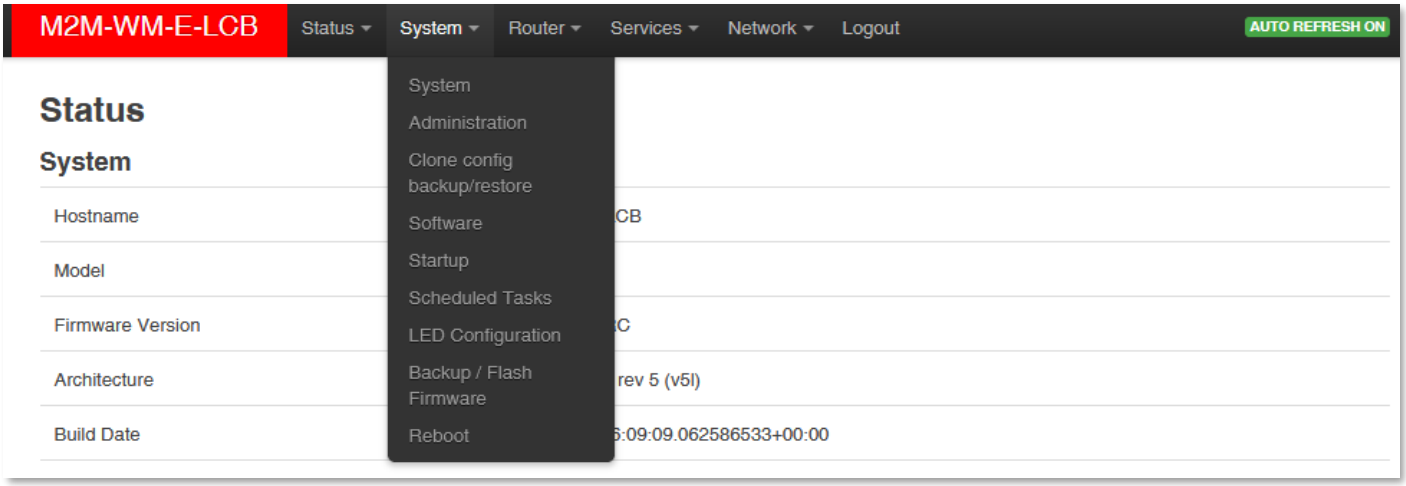
- In the **Status** you can check the current status (**Overview**).



- Check the **Firewall** traffic.
- Check the **Routes**.
- Check system messages and event log (**System Log**, **Kernel Log**).
- Check the activities of the device (**Processes**).
- You can find monitoring features of the realtime operation at the **Realtime Graphs.**

1.5 System menu

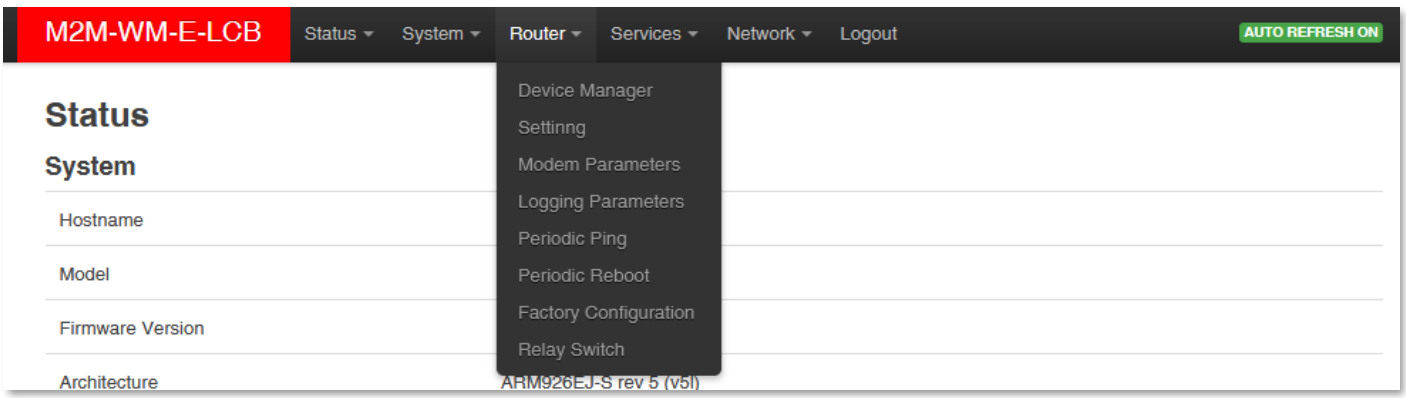
- You will found several system settings in the **System** menu (as **Hostname**, **Time synchronisation** (NTP), **Logging** and **Language** settings)
- And in the **Administration** menu also (**Password change** and **SSH Access**).
- **Clone config backup/restore** for easy cloning of the saved settings to an another device.
- Installation of further **Software** (3rd party tools, applications for the Linux distribution).
- You can define the **Startup** applicatons.
- Initialization of programs can be configured during the operation and the **Scheduled Tasks**.



- The **LED Configuration** is also configurable for custom needs.
- You also can **Backup** and restore your system configuration, applying **Flash firmware** updates.
- **Reboot** menu: for restarting the device.

1.6 Router menu

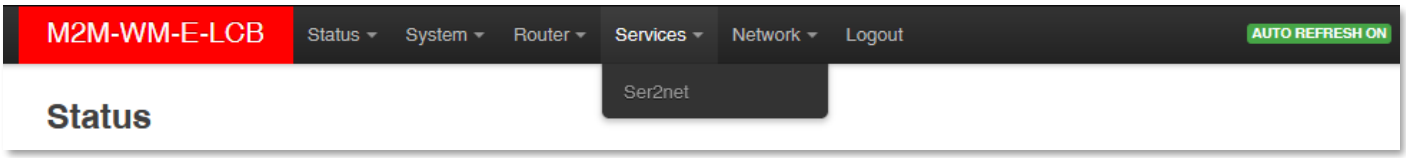
- **Device Manager** settings can be configured for remote device checking and managing from the Device Manager® software.
- **Modem Parameters** – watchdog settings for the cellular module.



- **Logging Parameters** – you can setup the log mode.
- Define **periodic ping** (for QoS check) or **periodic reboot** (for industrial standard or safety reasons).
- **Factory Configuration** – save the last good known settings or reload the factory settings
- **Relay Switch** – Relay output settings (configure the control of lighting units / switches)

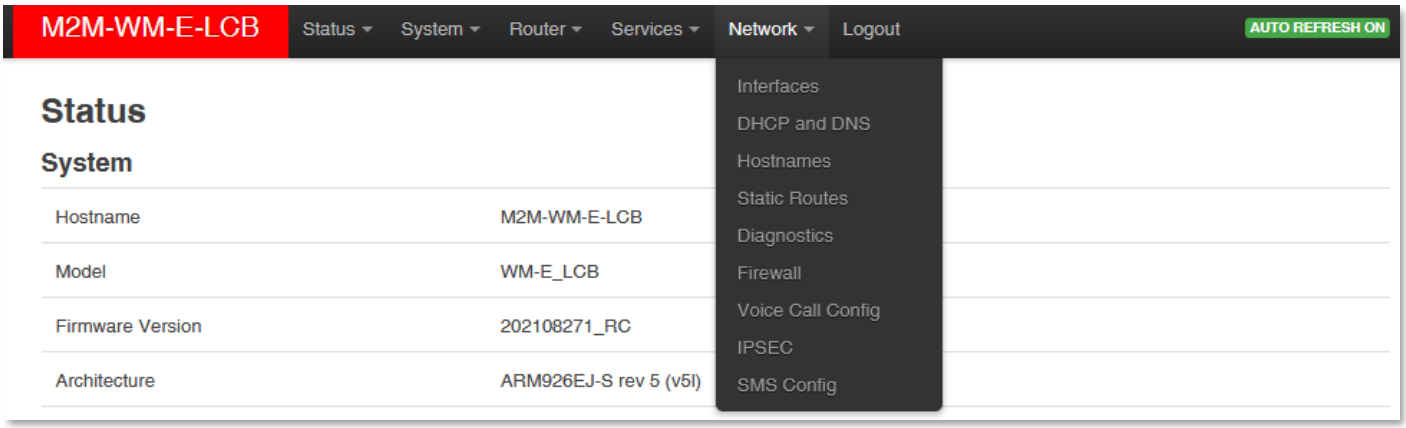
1.7 Services menu

- **Ser2net** – RS485 port settings



1.8 Network menu

- Here are the settings of each network **Interfaces** (for cellular module and Ethernet port)
- You can define the **DHCP and DNS** settings for the wireless LTE module and connection.



- Define **Hostname** for the modem for easier identification of the device on your network.
- At the **Static Routes** are also configurable (IP route settings).
- At the **Diagnostics** menu, you can check network access (ping, traceroute, nslookup).
- **Firewall** settings for control and rule the incoming and outgoing, througput communication.
- The **Voice Call Config** menu is usable for remote control of the device (e.g. remote restart) – command execution by voice call
- **IPSEC** (tunneling settings for secure connections)
- At the **SMS Config** menu you can define (remotely executable commands) – execution by SMS messages

Chapter 2. Important notes

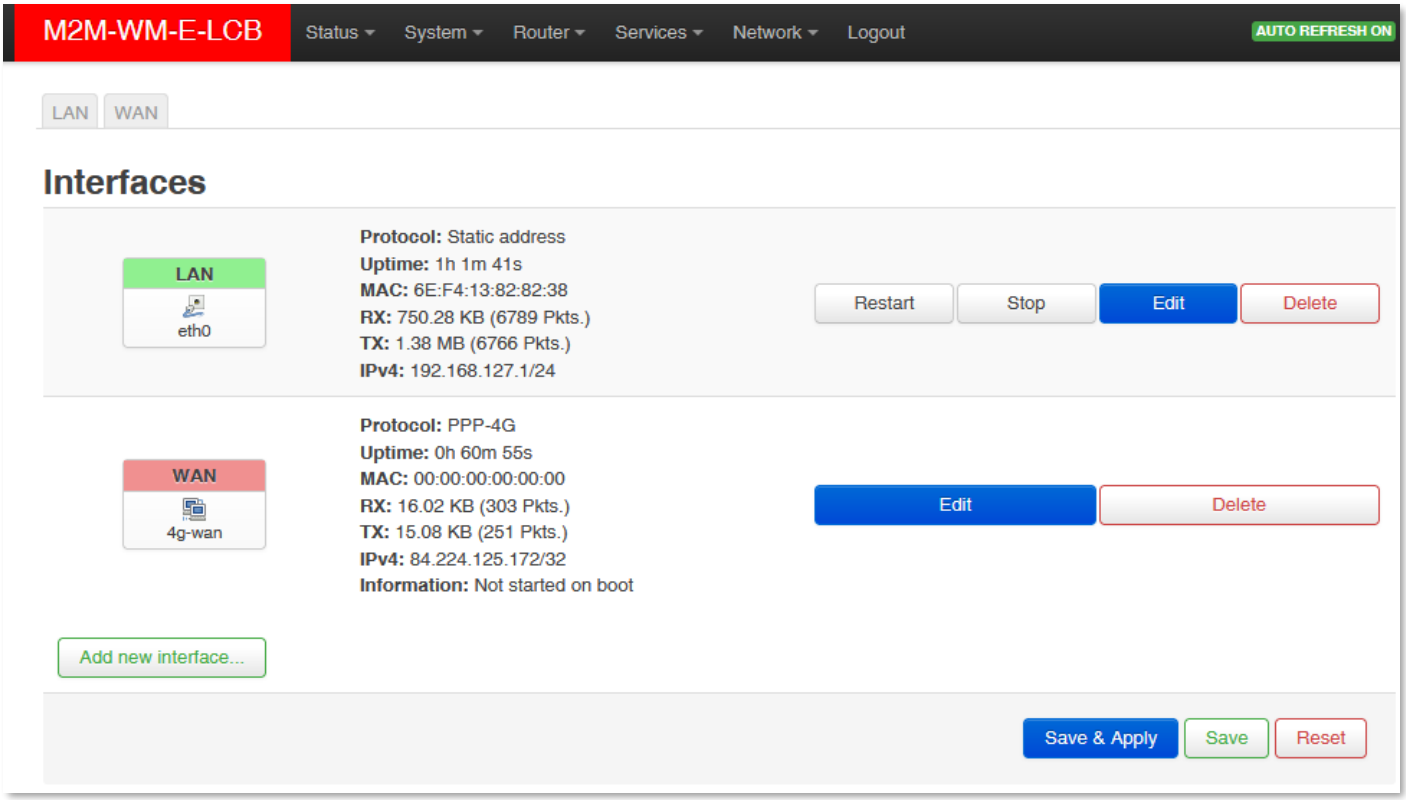
- By security reasons, we do recommend to **change the web user inteface login** and **password** as soon as you can.
- The **IPv6 protocol** is disabled for the LAN interface by default, change it if you want to use it instead of the IPv4 protocol. Use the **Network / Interfaces** menu **LAN** interface and the IPv6 relevant fields.
- The DHCP service is active, therefore the device will giving IP addresses for the connected devices, but the protocol which is used, configured for static IP addresses for the ethernet interfaces. If you want to use and distribute IP addresses by DHCP, change its protocol to DHCP client. You can change its settings in the Network / DHCP and DNS settings menu or in the **Network** / **Interfaces** menu, **LAN** interface and **DHCP** section.
- The **Firewall** service is active by default (by security reasons), therefore all communication is disabled excluding the used ethernet, DHCP, DNS and WAN channels, web port and the necessary services and ports for normal operation for the modem.
- We recommend you to disable all ports and protocols in the firewall which you are not using actively or which are not necessary to the connection and data transmitting by respecting the ports which are necessary for the general operation. Use to check **Status** / **Firewall** menu to check the data throughput and the **Network / Firewall** to configure new roles.
- The **firewall is not protecting the device against external network or DoS attacks**, if you just enable the firewall feature. For a massive and advanced safety, you have to customize the settings by harmonized with you used current network and connection settings.
- We offer to **check the network traffic** on your modem frequently by the **Status / Firewall** menu option to be ensured that all of your connections and active communication channels (port number, incoming IP) are using only the wanted paths and routes and listening the defined incoming activities and consequently occuring the estimated output traffic.
- We offer to **measure your throughput data and network traffic** (by minutes, hours) – use the **Status / Realtime Graphs** or **Statistics / Graphs** and calculate the estimable data transmitting amount according your expectations and the data limits of the used SIM card.
- By default, the modem has an installed OpenWRT® operating system which is ready to use and configure to your SIM card APN and for you usage requirements.

- The device has 4G LTE wireless transmission capabilities and 2G/3G fallback in case of the unavailability of the 4G network. In this case, the device will operating on the 3G or 2G network. When the 4G network will be available again, the device will switch back to the 4G network. This feature is configurable for the **WAN** interface of the device.
- You can check the current cellular signal reception and wireless availability in the *OpenWRT® / LuCi® system's* **Overview** menu.
- The available APN settings will be assured by the SIM card provider mobile operator or your mobile internet service provider. Ask them about ***APN***, password, ***SIM PIN*** and further necessary information for the configuration.
- If you want to use the device on the wired network (LAN) with RS485 option, then remove the **WAN** interface by the **Delete** button in the **Network / Interfaces** menu. The device will not be restarted further - even if there is no SIM card inserted.
- The **RS485** port should be configured before usage, which can be found in the **Services** / **Ser2net** menu. There you can configure RS485 data speed rate betweeen 300 baud and 115 200 baud, but please consider that max. 19 200 baud is guaranteed to receive by the device. Note, that we offer to use **9 600 baud** or **2 400 baud** speed rate, which is standard and there can be guaranteed that it will work. With higher data speed rates some connected systems can cause loss of characters/data in case of some connected device(s).
- Note that the device is not detecting the relay connections, it is just signaling the relay switch by the **REL.1..4** LEDs. The compatibility settings should be done at the **Router / Relay Switch** menu.
- Note that all relays are latching relays, which means the device remains the last switching status (even if the power was taken). The **Relay 1** and **Relay 2** having NC, NO, COM pins (and it has two switching mode, where the SET and RESET are also available) while the **Relay 3** and **Relay 4** having only NC and COM pins (does not have RESET, just SET).
- Note, that the device has supercapacitor component inside, which protects the device against possible shorter power outages. In case of a power outage - due to the supercapacitors – the device has enough enegy to provide a safe disconnection and shutdown (before the supercaps will be exhausted). The same if you store the device for months without connecting a power source or using it. Therefore, this component must be charged before usage. When powering the device, the charge of the supercapacitors will be started automatically. The system will be started by the device only after the end of the charge process.

Chapter 3. Network configuration

3.1 Interface settings

The list of the available network interfaces can be found at the **Network / Interfaces** menu item.



The **LAN** interface is listed for configuring and using the device with your PC or an external device through the Ethernet connection (***eth0*** interface).

The **WAN** interface means the wireless Internet connection (as ***4g-wan***) the physical 4G cellular module.

<u>Modifying the interface settings</u>

At the interfaces, at right you can modify the settings with the 

button.

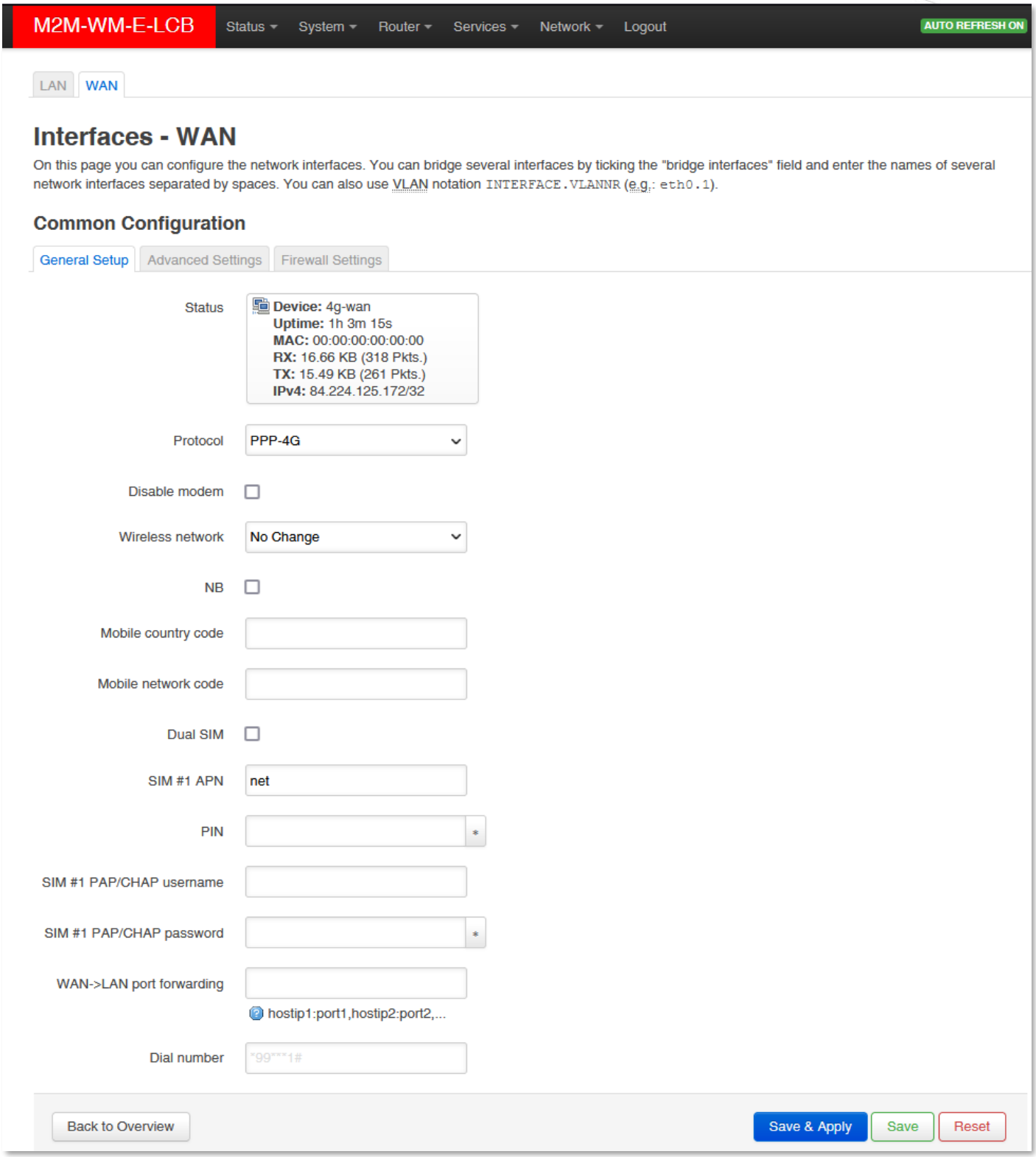
The **Stop** button stops the communication on the current interface, the 

button reconnects the related interface connection.

3.2 Cellular internet (WAN) settings

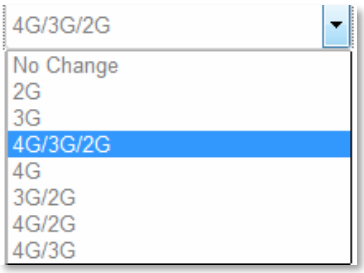
The wireless module / cellular network settings of the modem can be configured at the **Network** menu, **Interfaces** menu item. Open the **WAN** item from the interface list by the ***Edit*** button.

The wireless connection can be operated through the dynamic and static IP address (IPv4) assignment also - which is provided by your mobile operator.



At the **General Setup** tab, you can see the current status of the interface with transmitted data amount.

The device detects the 4G module and configuring. You only have to setup the **APN** you want to use for the **WAN** (*ppp-4g*) interface and the **PIN** code of the SIM (if it is presented).



The ***Wireless Network*** field gives you the opportunity to choose a dedicated cellular technology or you can leave it on default value: *4G/3G/2G* – which means the ***Auto*** mode.
This mode could grant the best speed and quality option (for *4G* selection), or the garanteed operation on any network (*fallback* feature for *4G/3G/2G* selection (when the 4G cellular network service is not available the 3G will be used – it 3G is not available, or 2G fallback will be used – when 3G or 4G will be available again, it will switch back to 4G) – **if the internet module of the device's supporting this.**

If you have to use a dedicated network like 3G, 2G, etc., then choose the required network type, please. But **take consider, that the „fallback" feature will be inactive in this mode** – if you choose the *4G* and it the network will be not available, there will not be provided 3G or 2G fallback (if the choosen network is not available, the device won't get mobile network access). For fallback always choose the ***Auto*** mode (4G/3G/2G setting).

If you choose the ***No change*** option, the device will be using the last known good configuration here.

There you can also define the **SIM #1 APN** name for the Internet connection, which is necessary to use. **If you will not set any value** for the *APN*, the modem will restart the modem sequentially in every ca. 10 minutes until it is not configured properly.
You can define SIM card's **PIN** code here - if it is necessary for the connection.
Note, that the **PIN** code which is already configured here, it cannot be seen here due to the security rules – the characters are placed by asterix signs. Just modify the PIN if you would like to change.

Important! *If you need to change the PIN code, use the Network / SIM PIN Change menu item.*

<u>Authentication methods:</u>

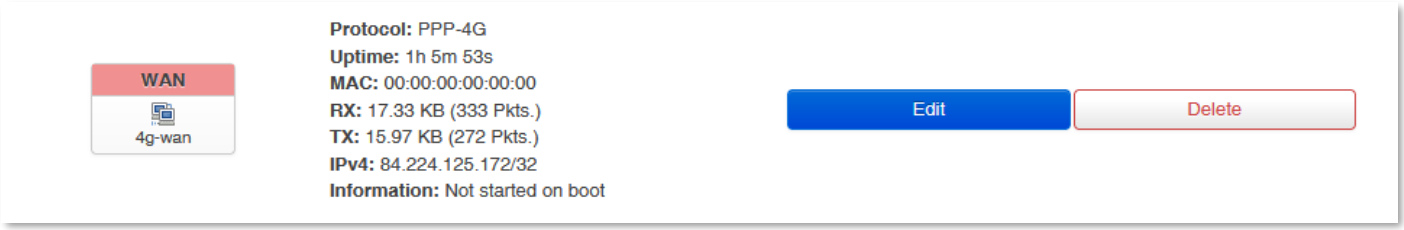
- The **SIM #1 PAP/CHAP username** and **SIM #1 PAP/CHAP password** settings can be also configured here – if it is required for the connection.

- If you need dialup connection for using the Internet service at your provider, set the **Dial number** value (format: *99***1#).

In case of roaming change the **Mobile country code** (MCC) settings to the related country code please. If you are attempting to use a dedicated cellular network, configure the MNC field (**Mobile network code**) please, according the needs. You will found the currently useable MCC / MNC settings here: https://mcc-mnc-list.com/list

Click to the **Save & Apply** button for saving the settings, while the device will be restarting the cellular module with the new settings and will connecting to the cellular network.

Then, you can check the data transmitting at the **Network** / **Interfaces** menu, when check the **WAN** interface status at the **Interfaces** part.



The device is already connected to the cellular network, it has active data traffic and the **RX** (received data), **TX** (transmitted data) at **Pkts.** (number of network packets) and **KB** (KBytes) values are growing.

The **WAN** interface data traffic will be signed by the **red** flashing of the **WAN** LED (together with the **green** flashing of the **LAN**) – which all can be indentified as **yellow**.

At the **Advanced Settings** tab you will found further settings for the wireless module.
By default we do not offer to change these settings, only if you are special requirements at operating the mobile network communication by the modem (these are the **LCP Echo** settings, the **Bring up on boot** and the **use built-in IPv6 management** parameters mainly).

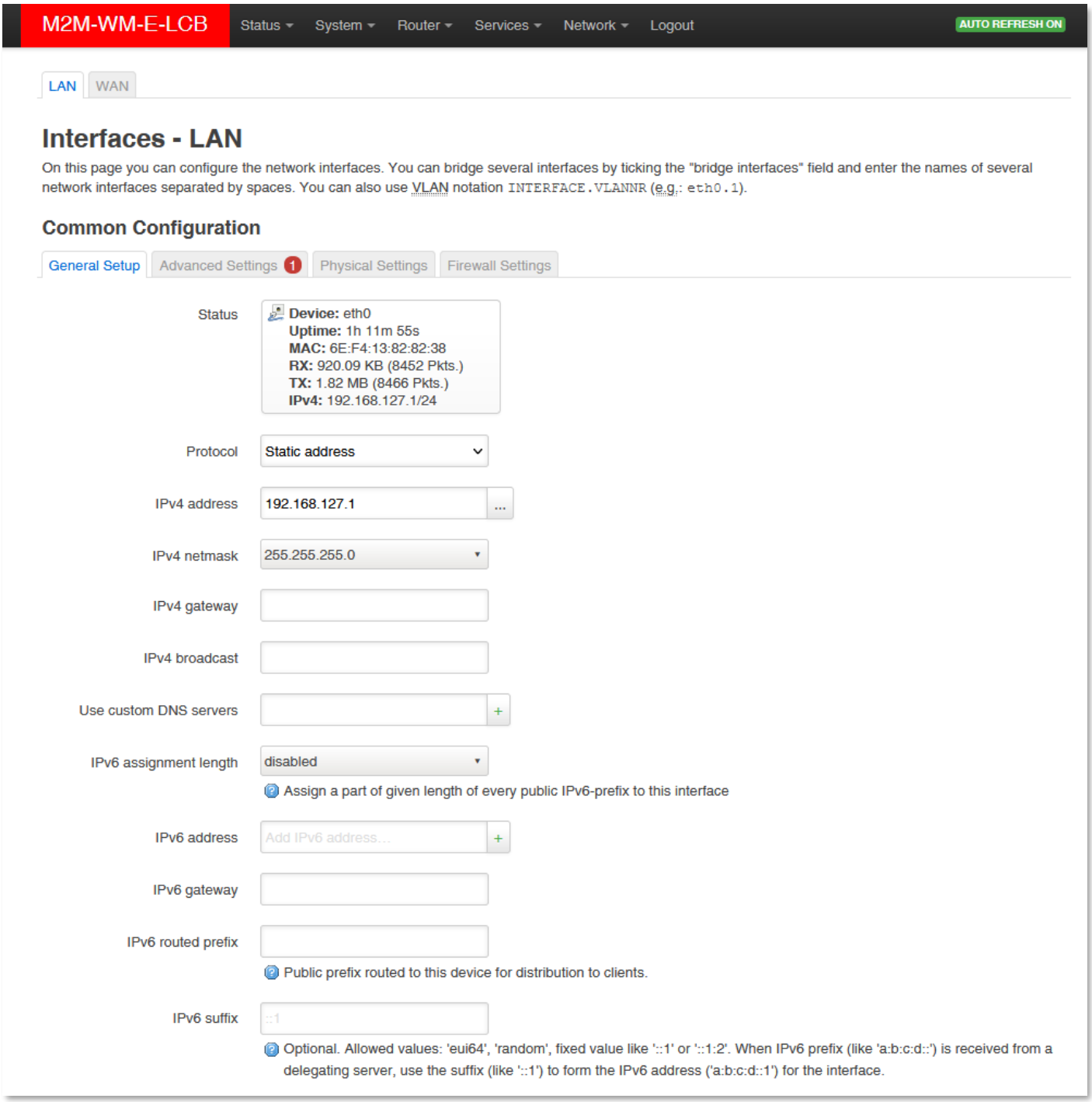
If you changed the configuration here, click upon **Save & Apply** button for saving the settings. Then the device will reconnecting the module to the mobile network.

3.3 Ethernet (LAN) settings

The detailed interface settings for the **LAN** Ethernet port (*eth0*) can be performed by selecting the **Network / Interfaces** menu item.

At the **LAN** interface's Edit button, choose the **General Setup** tab**.**

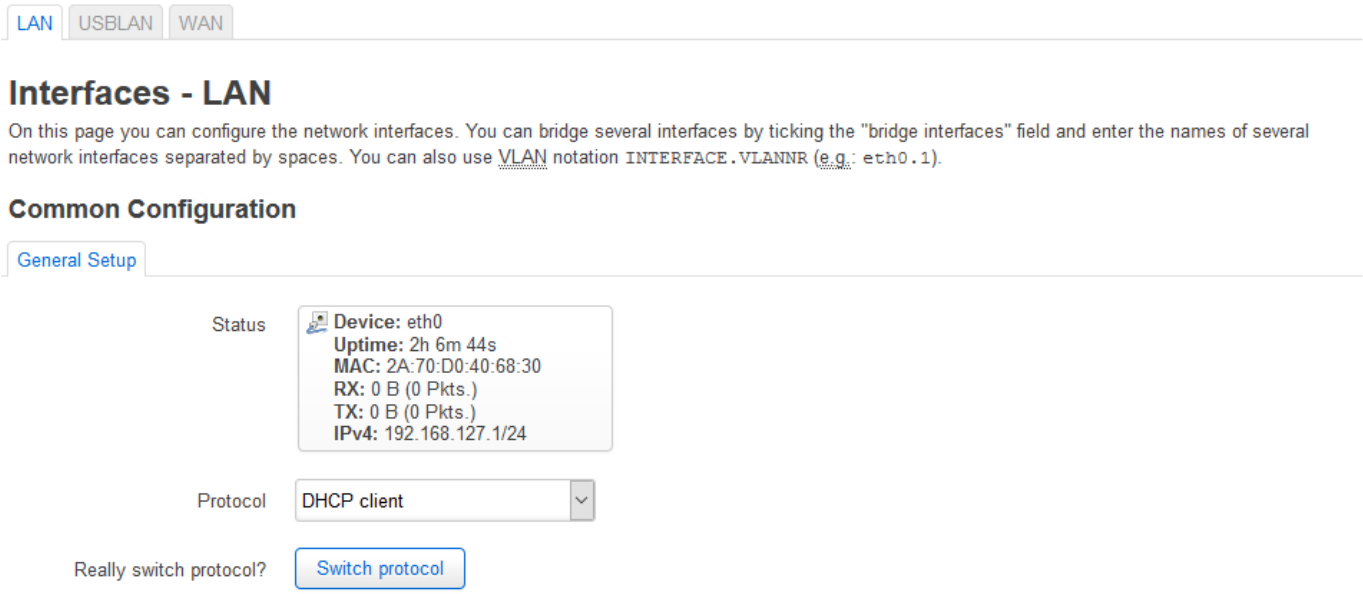
By default the Ethernet IP address is *static*, the default IP address is: 192.168.127.1.). If you want to switch the **LAN** (*eth0*) interface to *dynamic* (at **Protocol** field), then the device will waiting for an IP address on the network.



Define a new **IPv4 address,** check the **IPv4 netmask** (subnet mask), **IPv4 gateway** values for your devices according to your needs – to be able to serve your connecting devices.

When changing the **Protocol** field, you need to push the Switch protocol button.

If you want to use the local *DHCP server* – to allow to add IP addresses by the device for the connecting external ethernet devices – then the right setting is the *Static Address*, and the **IP address** should be also changed, and you have to uncheck the *DHCP disabled* option for the **LAN** interface to allow the DHCP server.

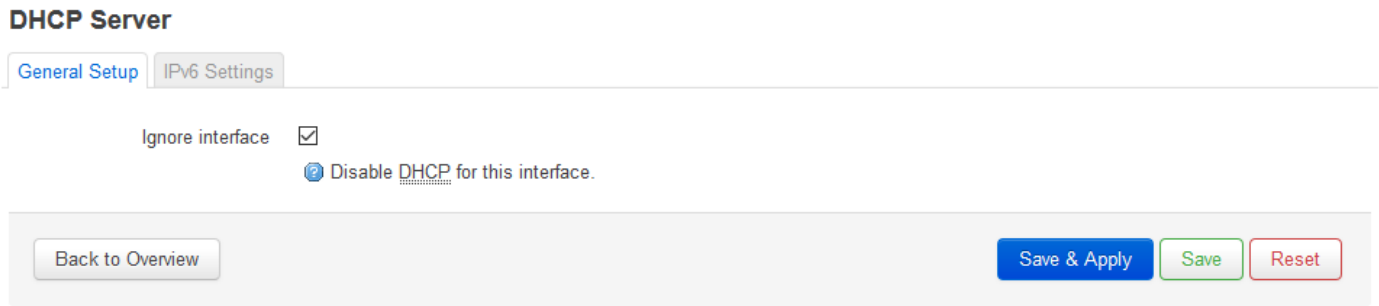


Save your settings by the **Save & Apply** button, and the **LAN** interface IP address will be changed according your request due to the new settings.

3.4 DHCP and DNS

The DHCP and DNS settings can be achieved at **Network** menu, **DHCP and DNS** item at **General Settings**.

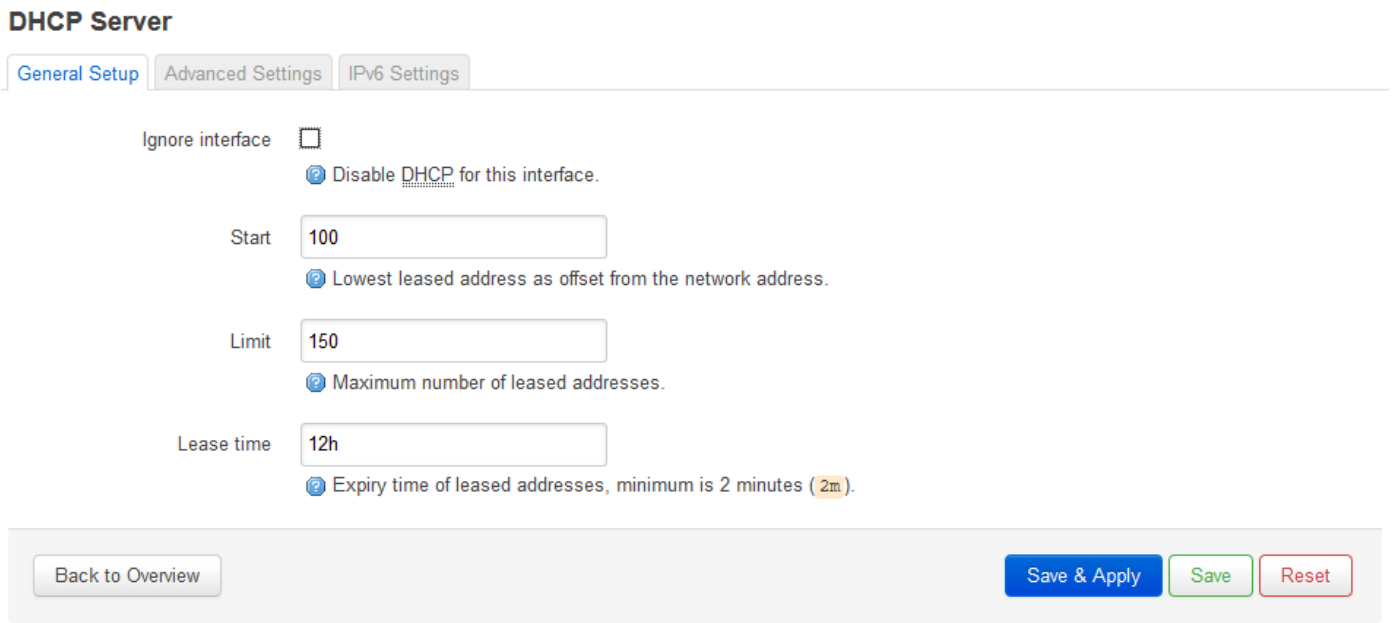
Below, at the **Active DHCP Leases** part you can see the list of the devices, which given their IP addresses from the modem's DHCP service (with the renewal *lease time*).



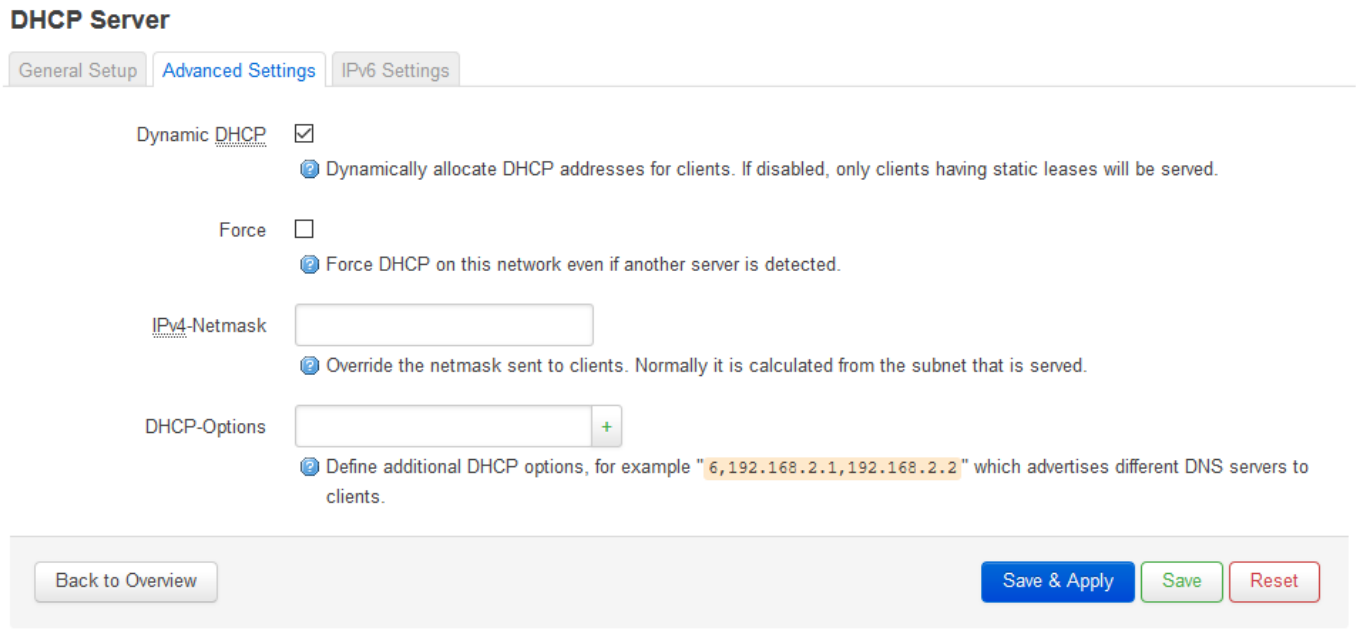
To enable DHCP, uncheck the **Ignore interface** option. The fields required for DHCP configuration and their default values are displayed.

The **Start** field means the starting address within the subnet used by the router (in our case 192.168.x…).

Use the **Limit** field to limit how many IP addresses are assigned. That is, the router on subnet 192.168.x will assign IP addresses in the address range between **Start** and **Start + Limit** to the devices that want to connect.

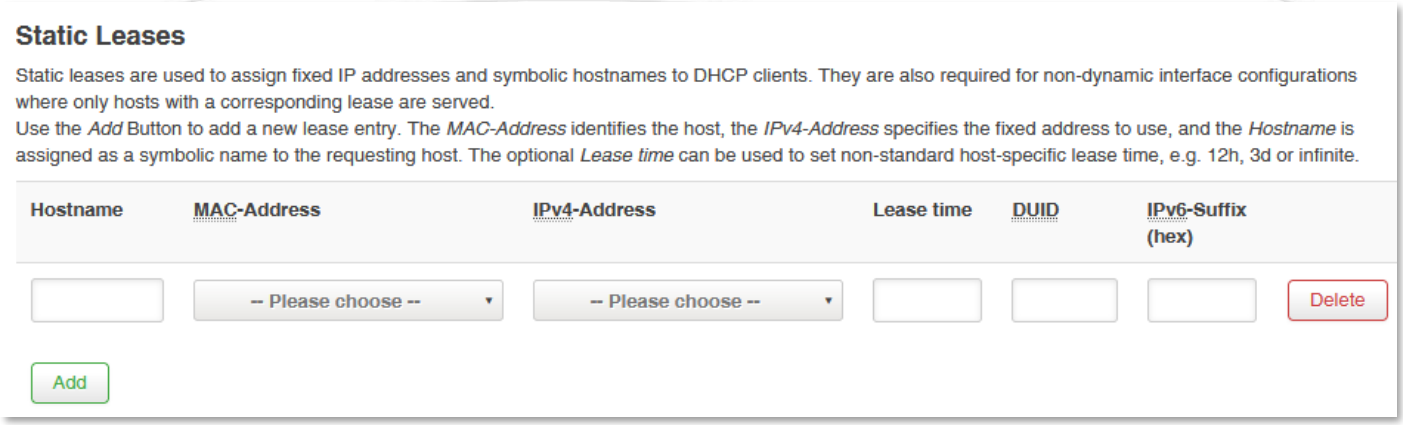


Further settings can be achieved at the **Advanced Settings** tab (as dynamic DHCP, *IPv4 Netmask*). Save your settings with the **Save & Apply** button.



Further DHCP server settings can be found in the **Network / DHCP and DNS** menu. Here you can see and configure them under the **General Settings** tab.

At the **Static Leases** you can add network devices by the Add button to be guaranteed to get the same IP address after every leade time renewal. Define a **Hostname** and the valid **MAC-Address** of the device and the required **IPv4-Address**.

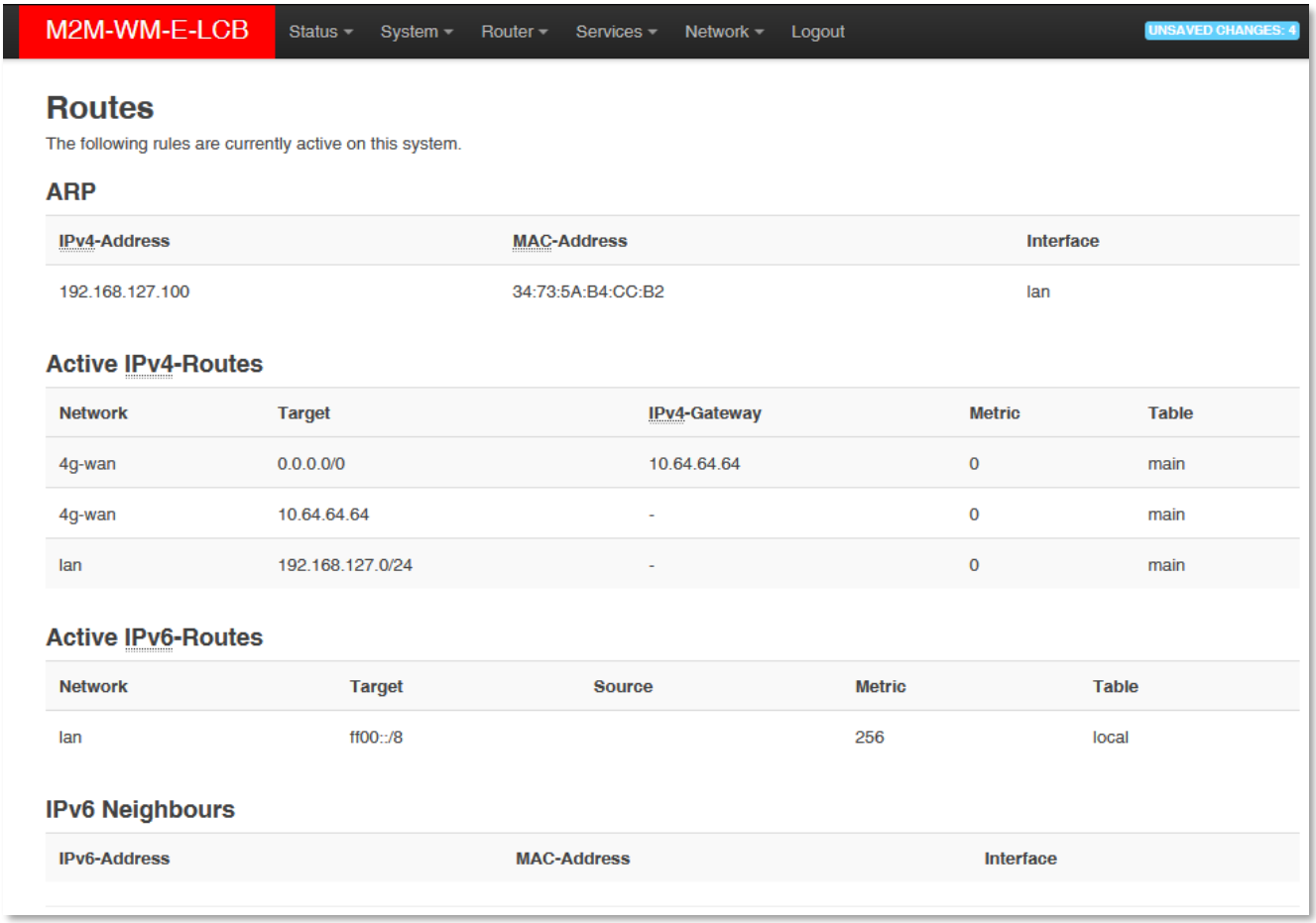


When you have modified the settings, save them by the **Save & Apply** button.

3.5 Defining route rules (Static route)

The current IP Route settings can be checked in the **Status / Routes** menu. We offer to check the currently used route rules - ARP routes, and the IPv4 and IPv6 route rules.

To modify the settings or define new rules you should use the **Network** / **Static Routes** menu.



Here you can define a new IP route rule, by the Add button.

These can be performed by choosing the related interface and adding the **Host-IP or Network** name, the **IPv4-Netmask**, and **IPv4-Gateway**.

To apply the new settings, **Save & Apply** your settings you made here.

3.6 Firewall settings

By default, the firewall service is active, but it allows all communication. It can be necessary to limit the traffic.

> ***Important!***
> *We offer to check the network traffic on your modem. Check connections and active communication channels (port number, incoming IP) and listen the incoming activities and the output traffic!*

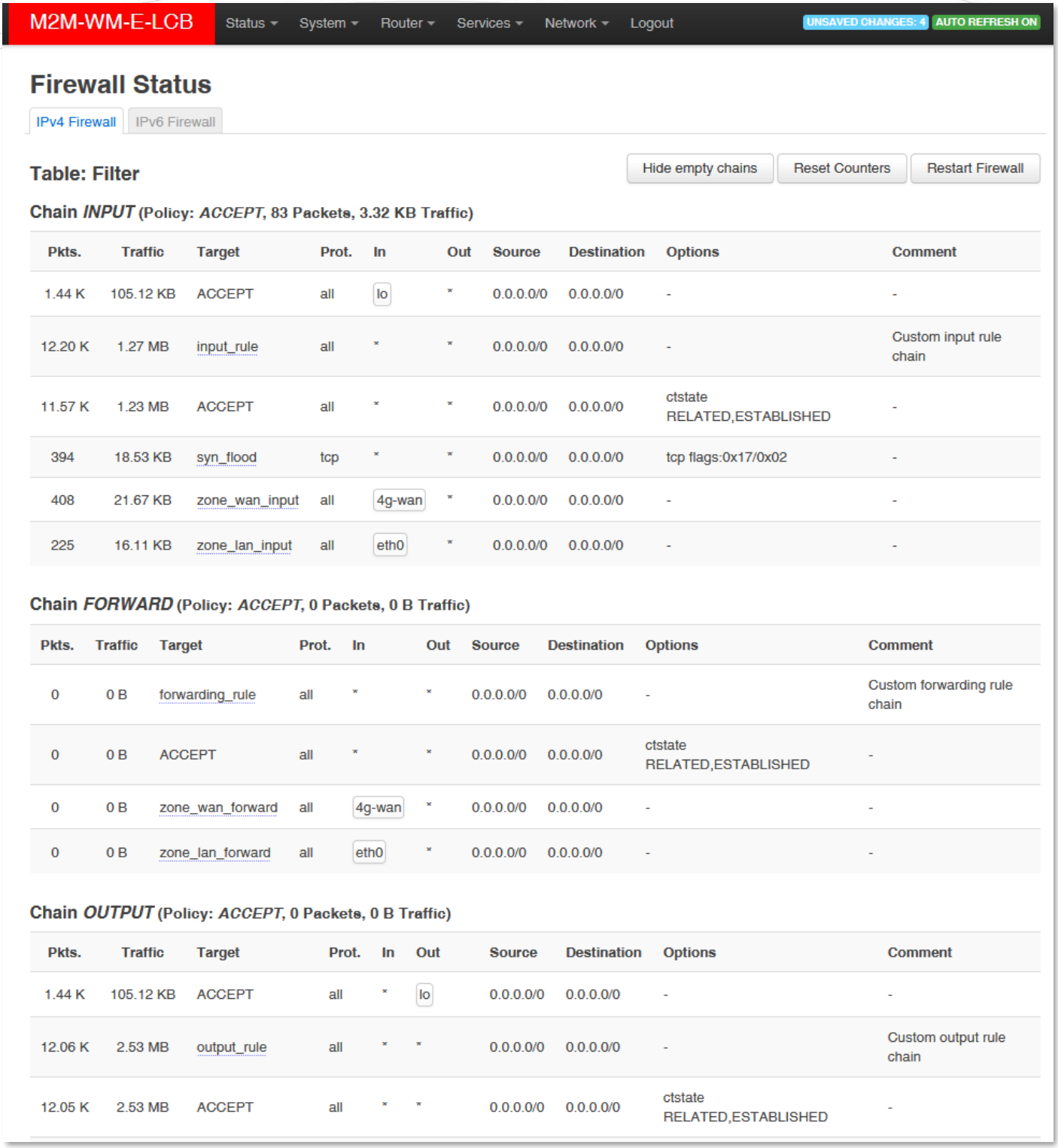
We highly recommend to check the firewall settings and configure the communication to reject the unnecessary boundaries.

On the public Internet, you can have several network attack and getting unwanted communication, internet data collection by applications. These all over the unwanted network activity causes the growing the mobile network traffic and increasing the transmitted amount of data (which is unnecessarly decrease the available data package amount of the SIM card in the modem).

You can check all of these at the **Status** menu**, Realtime Graphs** item at the **Connections** tab – where these can be listed.
If you'll identify some communication from an unwanted IP/port address/range, then you can disable or limit the affected port or IP-segment at the firewall setting rules to deny/prohibit this traffic by disabling the communication on it.

In the **Status** menu, **Firewall** menu item you can check the actual firewall statistic.
The ***INPUT chain*** means the incoming, the ***OUTPUT chain*** is the outgoing/transmitted and the ***FORWARD chain*** means the forwarded communication/traffic hereby.

You can also see the **Reject**ed chain here below.



M2M-WM-E-LCB | Status | System | Router | Services | Network | Logout | UNSAVED CHANGES: 4 | AUTO REFRESH ON

Firewall Status

IPv4 Firewall | IPv6 Firewall

Table: Filter

Hide empty chains | Reset Counters | Restart Firewall

Chain *INPUT* (Policy: *ACCEPT*, 83 Packets, 3.32 KB Traffic)

Pkts.	Traffic	Target	Prot.	In	Out	Source	Destination	Options	Comment
1.44 K	105.12 KB	ACCEPT	all	lo	*	0.0.0.0/0	0.0.0.0/0	-	-
12.20 K	1.27 MB	input_rule	all	*	*	0.0.0.0/0	0.0.0.0/0	-	Custom input rule chain
11.57 K	1.23 MB	ACCEPT	all	*	*	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED	-
394	18.53 KB	syn_flood	tcp	*	*	0.0.0.0/0	0.0.0.0/0	tcp flags:0x17/0x02	-
408	21.67 KB	zone_wan_input	all	4g-wan	*	0.0.0.0/0	0.0.0.0/0	-	-
225	16.11 KB	zone_lan_input	all	eth0	*	0.0.0.0/0	0.0.0.0/0	-	-

Chain *FORWARD* (Policy: *ACCEPT*, 0 Packets, 0 B Traffic)

Pkts.	Traffic	Target	Prot.	In	Out	Source	Destination	Options	Comment
0	0 B	forwarding_rule	all	*	*	0.0.0.0/0	0.0.0.0/0	-	Custom forwarding rule chain
0	0 B	ACCEPT	all	*	*	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED	-
0	0 B	zone_wan_forward	all	4g-wan	*	0.0.0.0/0	0.0.0.0/0	-	-
0	0 B	zone_lan_forward	all	eth0	*	0.0.0.0/0	0.0.0.0/0	-	-

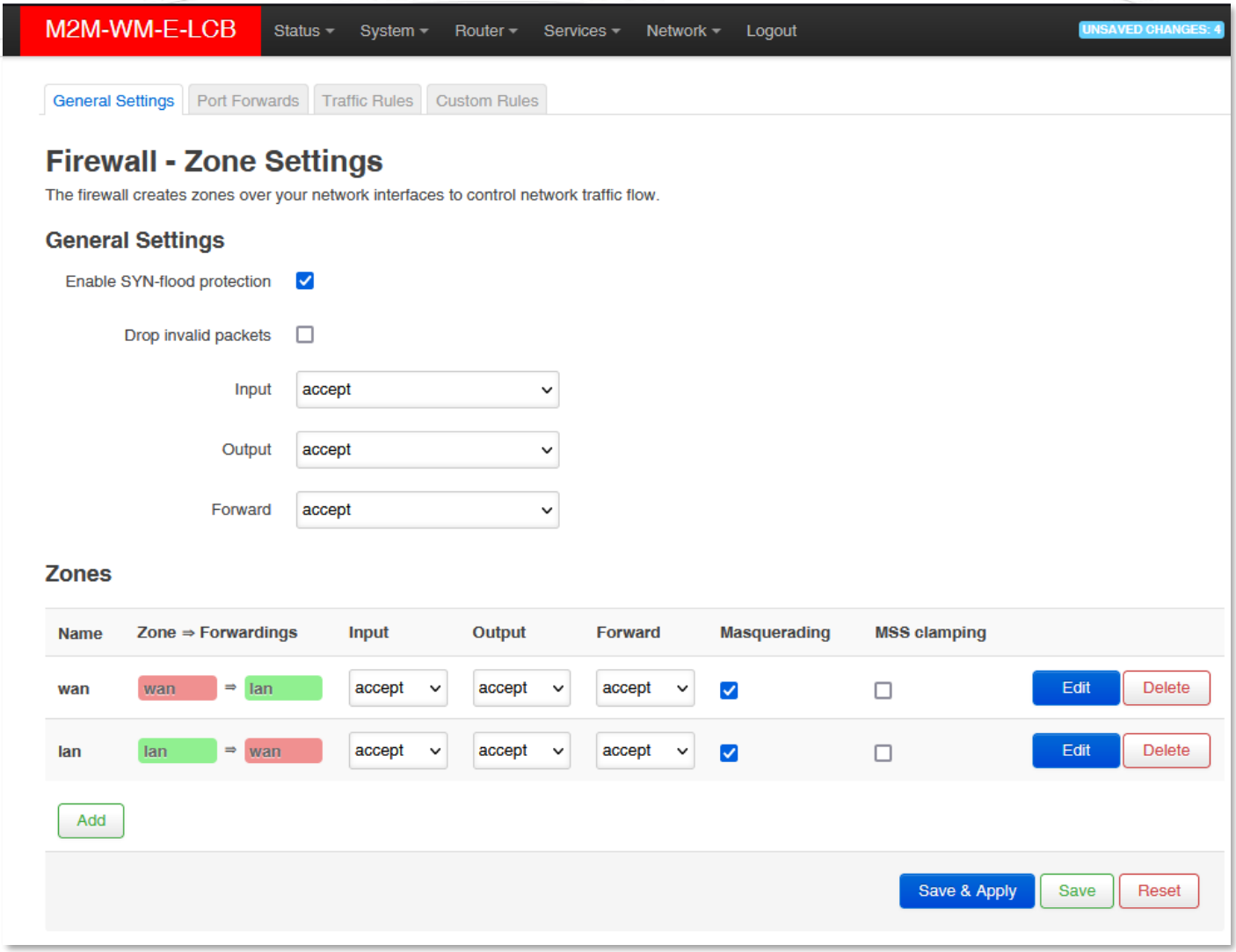
Chain *OUTPUT* (Policy: *ACCEPT*, 0 Packets, 0 B Traffic)

Pkts.	Traffic	Target	Prot.	In	Out	Source	Destination	Options	Comment
1.44 K	105.12 KB	ACCEPT	all	*	lo	0.0.0.0/0	0.0.0.0/0	-	-
12.06 K	2.53 MB	output_rule	all	*	*	0.0.0.0/0	0.0.0.0/0	-	Custom output rule chain
12.05 K	2.53 MB	ACCEPT	all	*	*	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED	-

As it can be seen, there are several communicating IP addresses on several ports for the device and subnet.

Another method for limitation is to disable all ports, to open and enable only the necessary and used communication ports, define the used IP address range by allowing exact IPs.

You can modify the firewall settings at the **Network** menu, at the **Firewall** item, **General Settings** tab.



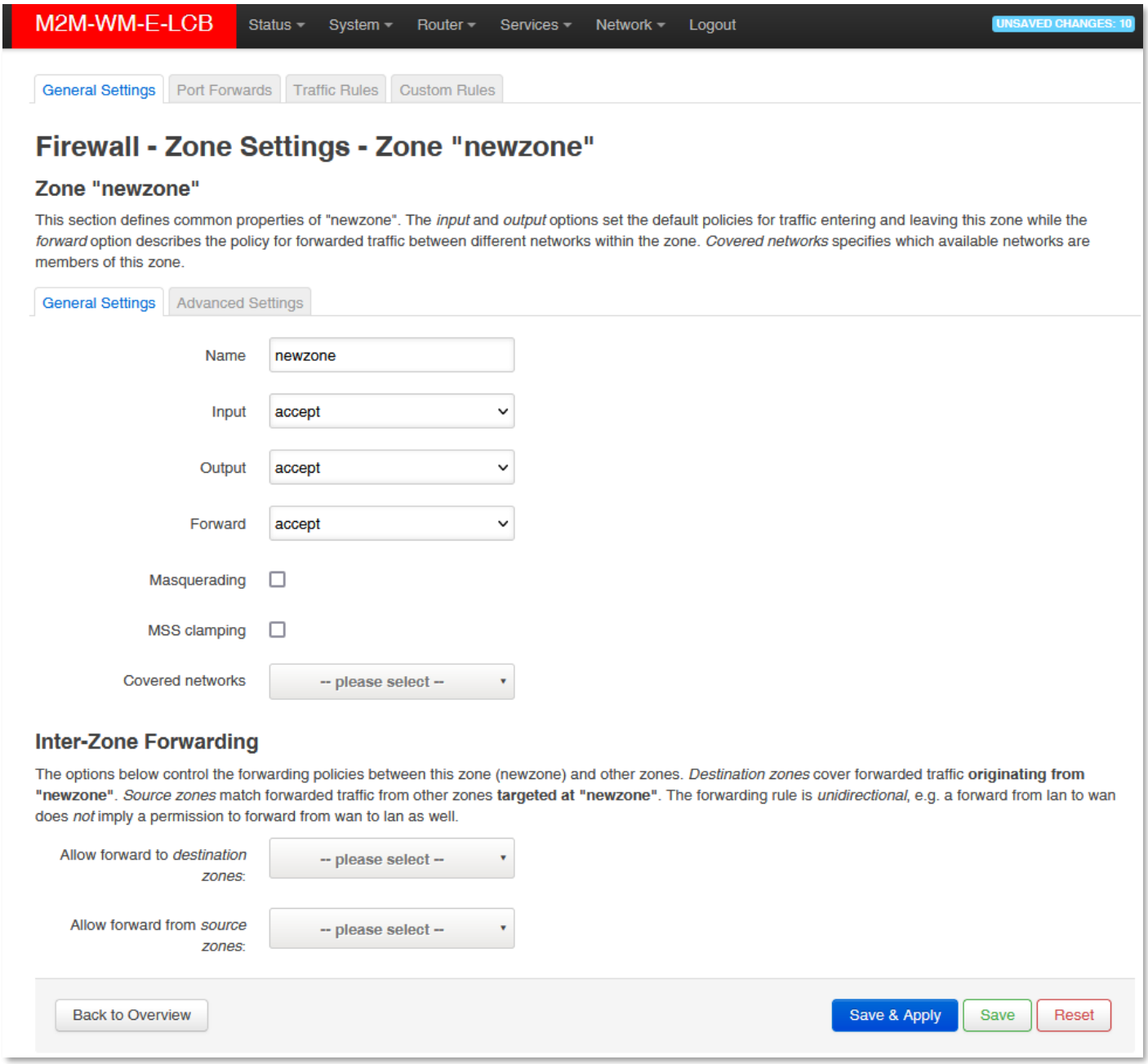
As you can see, the communication rules are listed here by their acceptance (*Accept/Deny/Reject*) with the directions of the communication (*br-lan* to *wan* or other).

Here, you can check or modify these firewall rules for the communication, at the **Input** (incoming), **Output** (outgoing) and **Forward** operations one by one by **accept** it, or **reject**, **drop.**

You can **Delete** the settings or Edit modify. Below, at **Zones** part you can Add a new rule to the current ones. You also can Delete or Edit an existed rule. Save modified settings by **Save & Apply** button.

When you'd like to **add new rule to the firewall settings,** it must done **carefully**, because you can disable or tilt some ports out of the communication so easy (which ports can be used by the device (by default) or they are necessary to existing for some network services or could required by some other running tasks). E.g. Port nr. 67 is used by DHCP service and the DNS which is also using a dedicated port (nr. 53).

Therefore you can add new port (which you have configured for the relevant service) to the firewall rules by the Add button. Configure the port and save the settings. Don't forget to Delete the old, not relevant rule for the service. For modifying the Firewall settings, choose Edit button.



For the port-level filtering or interface traffic limits or **Traffic Rules** settings are also necessary to define!

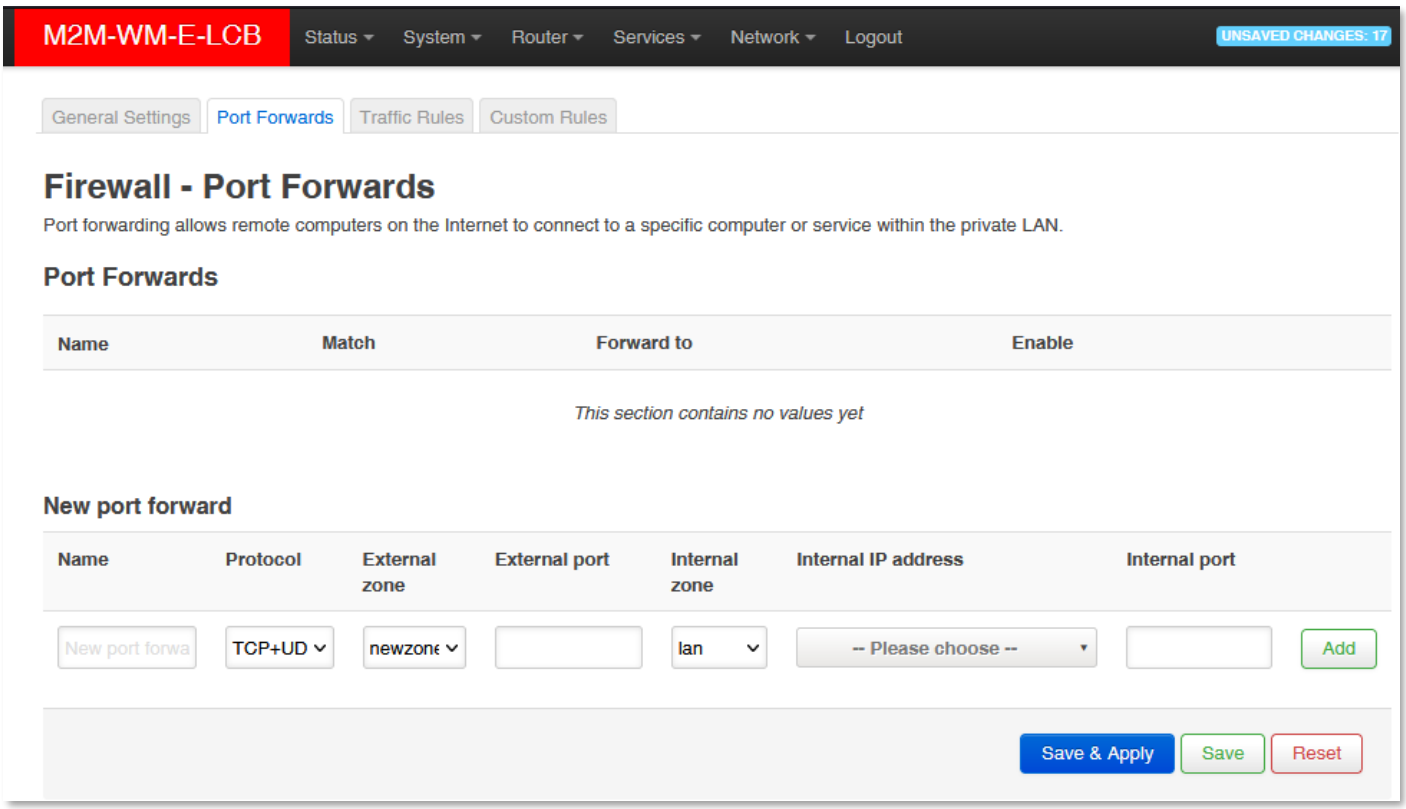
Here you can **Enable / Disable** or Edit, Delete a configured rule.

When you have modified the settings, save them by the **Save & Apply** button.

3.7 Port Forward settings

Here in the **Network** menu, at the **Firewall** item, **Port Forwards** tab you can setup the port forwarding rules for the modem.

You can add a new rule by the Add button. Where you can define a rule with the necessary **Protocols**, interface (**External zone** and **Internal zone**), Ports (**External ports**, **Internal ports**) and the **Internal IP address** values.

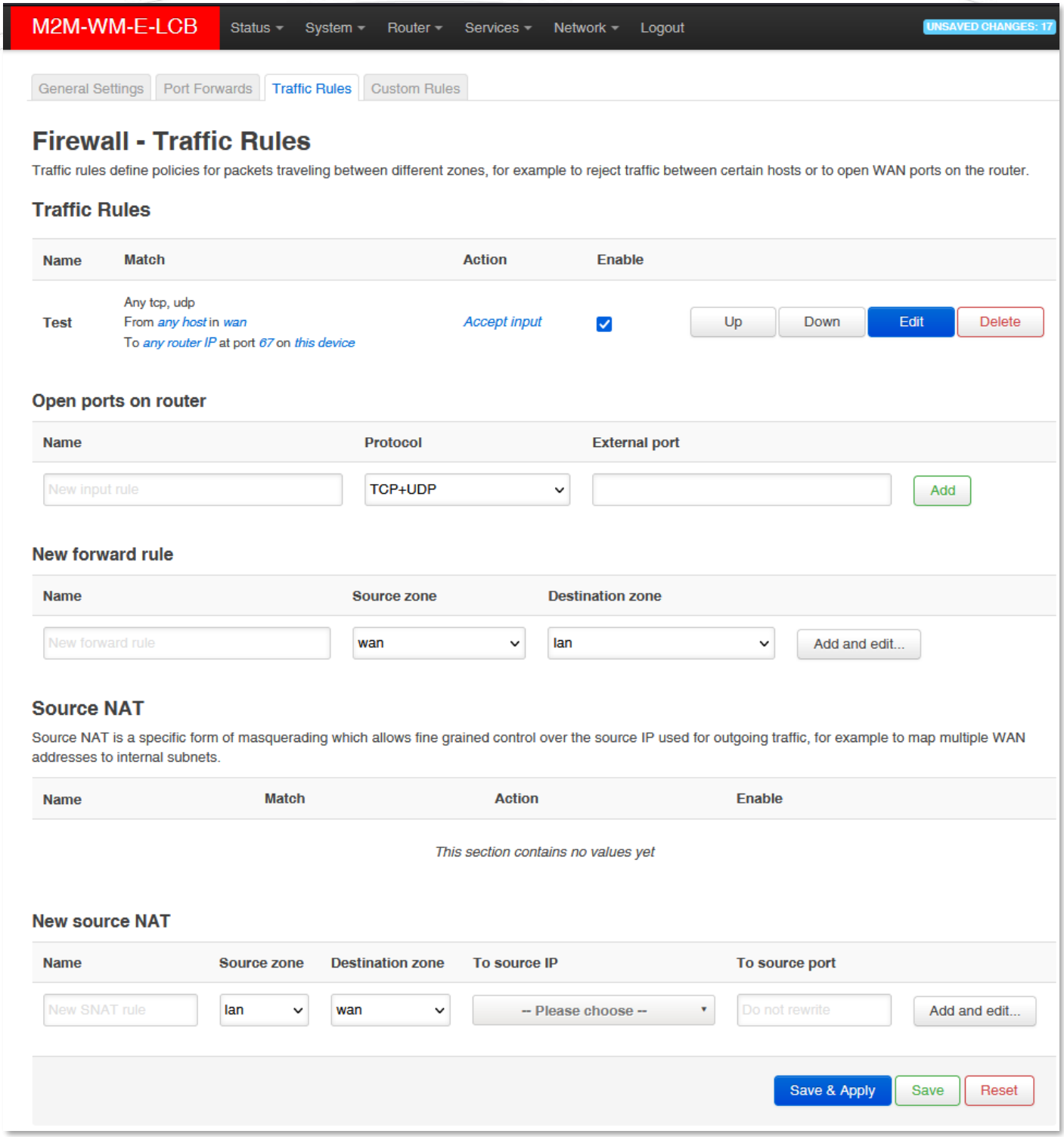


When you modified the settings, save them by the **Save & Apply** button.

3.8 NAT settings

In the **Network** menu, **Firewall** item, **Traffic Rules** tab you can setup the **Source NAT** settings. You can add a new rule by the Add button and **Save & Apply** to close the upcoming window.

Here you can open ports (e.g. for TCP) for the packages, or define new forwarding rule for interfaces (**New forward rule**).



The **Source NAT** settings (below) can be performed for each protocol (tcp, udp), that the modem allows the redirection of data –which incoming IP address and port must be redirected to which outgoing IP address and port and must be forwarded the data traffic. You also can define a port range, hereby.

When you modified the settings, save them by the **Save & Apply** button.

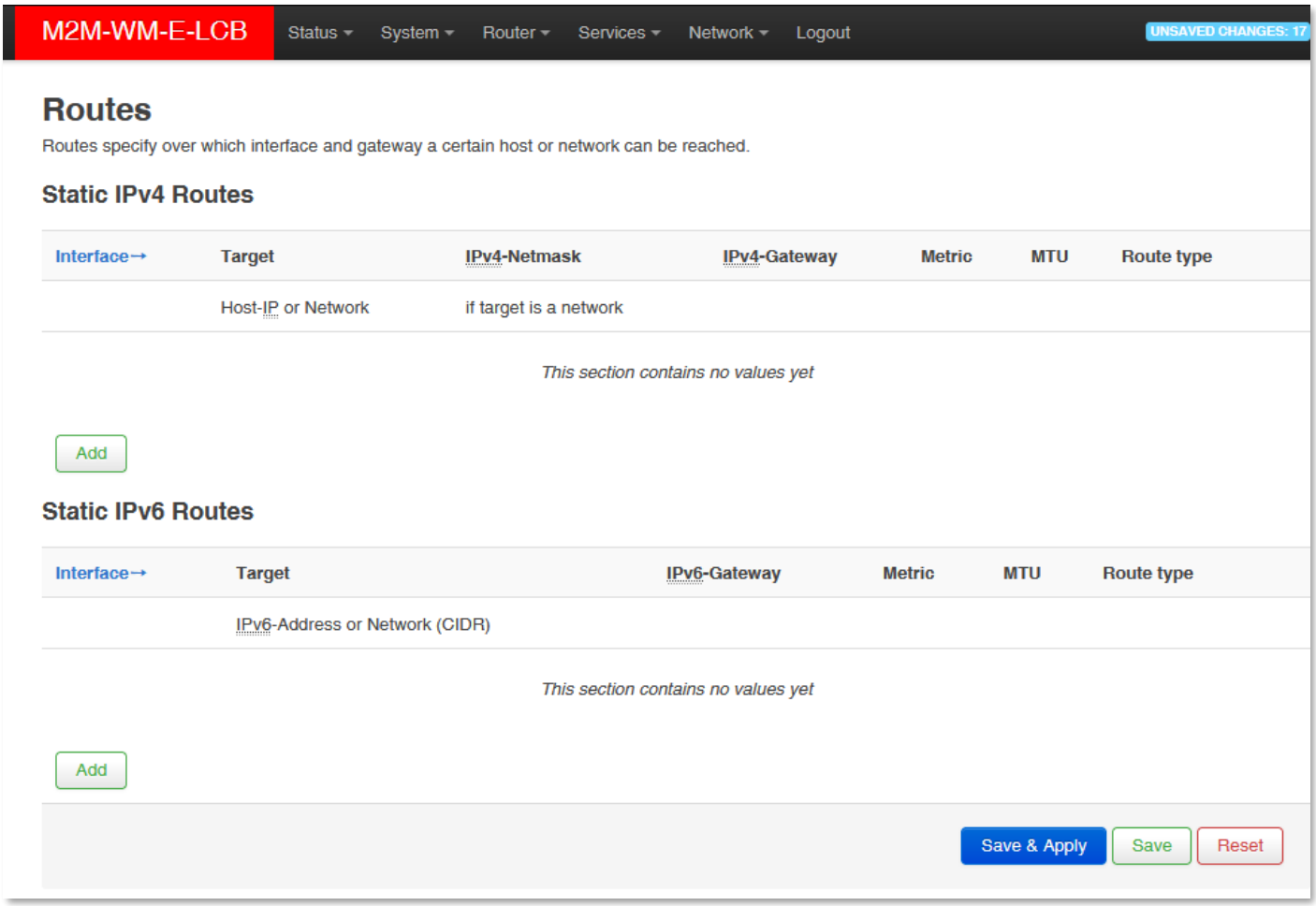
These rules must always be defined, not to disallow the general communication.

Take care, because it is easy to enclose the device from the network or disabling the remote access. Please, be careful when configure these settings.

> ***Important!***
> *Always check the standard ports, which are used by the network services and always allow these to operating (e.g. FTP: port 21, SSH/Telnet: port 22, DHCP: port 53, NTP time server: port 123, etc).*

The proper port filtering, routes are minimizing the communication, what could be important by safety reasons, and could decrease the open threads and risks of some safety leaks.
Always limit the access of services, and decrease the amount of the throughput communication on the network by these rules to provide the operation only for the necessary services, ports, ip addresses.
When you modified the settings, save them by the **Save & Apply** button.

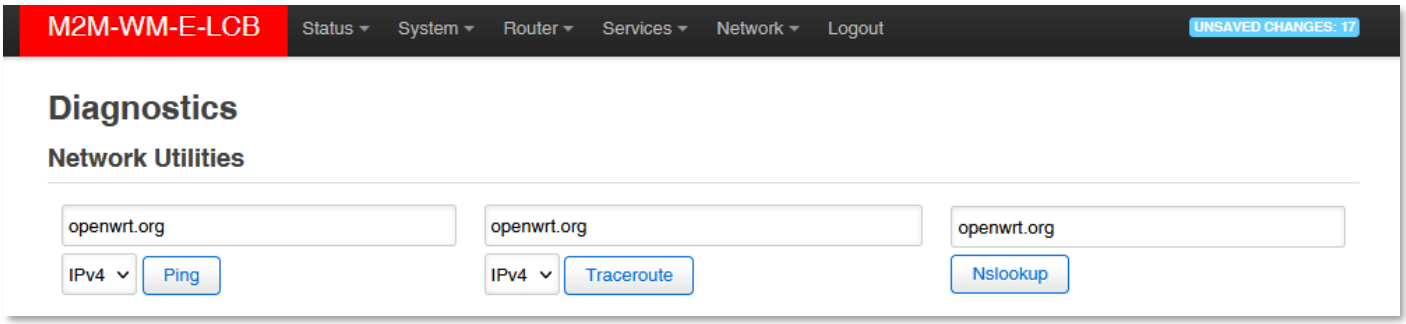
At the **Network** / **Static Routes** menu item you can define a new route.



Chapter 4. Advanced services

4.1 Ping IP address / checking IP

Open the **Network** menu, **Diagnostics** item.



Here you can check the availability of an IP address, that is it accessible (push Ping button), is there a naming service provided, and is there response between two IPs (push Nslookup button), furthermore you can query the path of the communication (by Traceroute button).
Then below you will get the results listed.

> ***Important!***
> *Check that IP addresses, which are accessable from the current IP segment and APN zone for sure (e.g. from an enclosed APN zone the device will not access the public internet, and from the public internet it will not access the enclosed M2M APN zone).*

> *In case of M2M APN the 192.168.1.250 address can be accessed, it is possible to ping the address for checking the 4G network connection.*

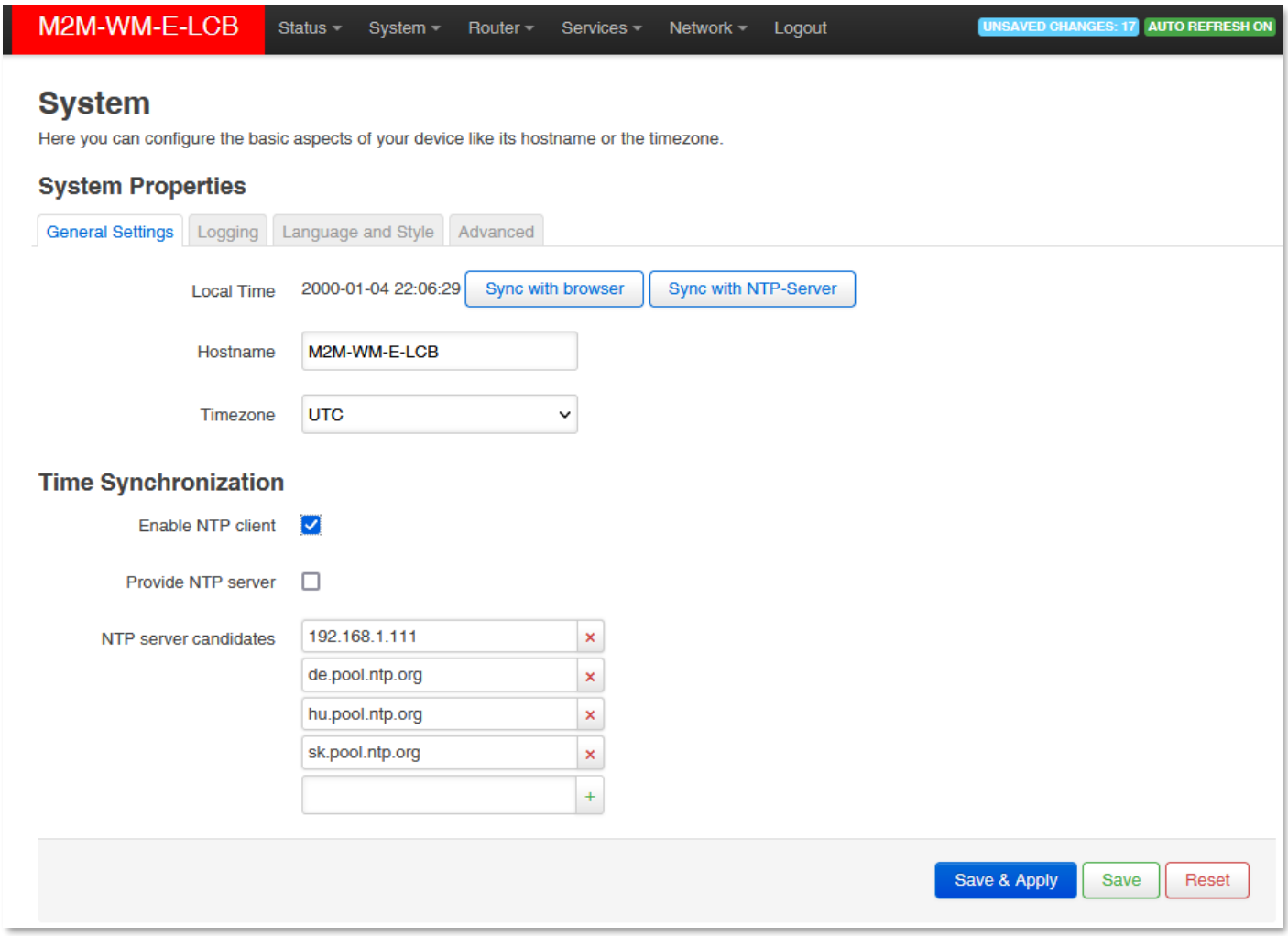
```
PING lede-project.org (139.59.209.225): 56 data bytes
64 bytes from 139.59.209.225: seq=0 ttl=54 time=29.080 ms
64 bytes from 139.59.209.225: seq=1 ttl=54 time=28.597 ms
64 bytes from 139.59.209.225: seq=2 ttl=54 time=26.848 ms
64 bytes from 139.59.209.225: seq=3 ttl=54 time=28.095 ms
64 bytes from 139.59.209.225: seq=4 ttl=54 time=27.842 ms

--- lede-project.org ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 26.848/28.092/29.080 ms
```

4.2 Network Time Service (NTP)

Important! *This NTP time synchronisation is highly important for data storage of the incoming readout results (metering files) on the modem's memory. Because the device uses file syntax with the current datetime values.*

The supercapacitor provides max. a few days of keeping the date-time values, but the NTP sync is also very important to keep updated time for the device and your data. Therefore we highly recommend you to configure NTP time servers and to test the proper functioning of this feature.

Open the **System** / **System** menu. At the **Time synchronistation** part, allow to **Enable NTP client** option and define an NTP server IP address (**NTP server candidates**).



If you allow the **Provide NTP server** option, the connected device(s) will getting NTP time from the WM-E LCB device.

The most NTP time servers are using the UDP Port nr. 123 for time synchronisation. You can find a NTP time servers on the Internet. Note, that the modem must access the public Internet for the NTP time server sync. Also take care of using the IPv4 and IPv6 dependent time servers.

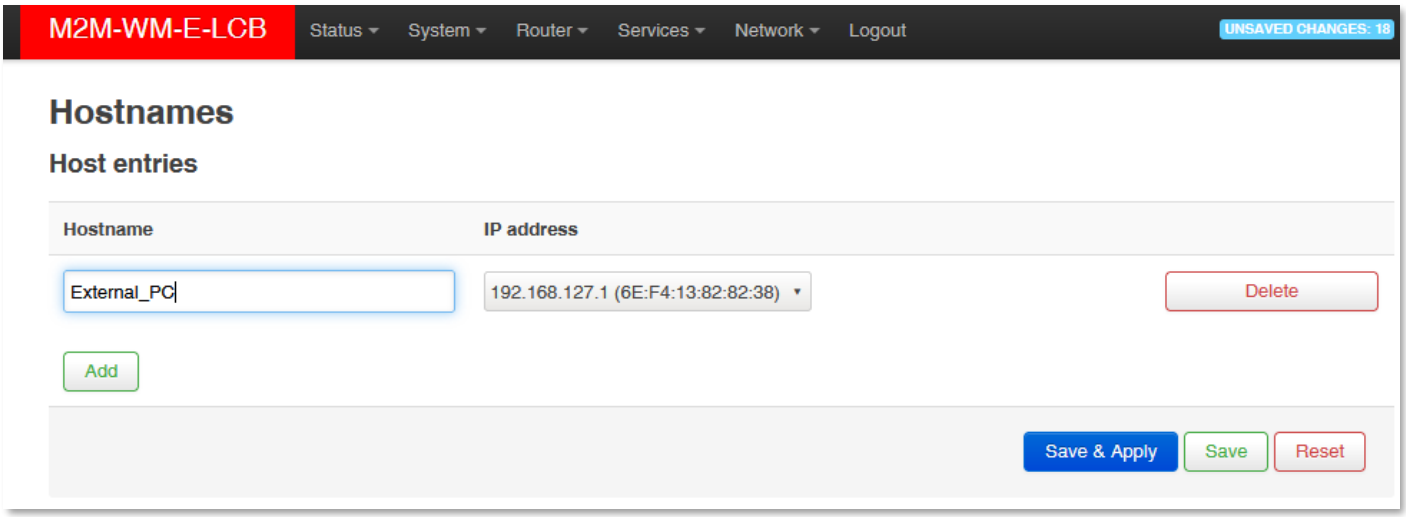
Save the settings by the **Save & Apply** button.

The time zone and synchronization of the system can be achieved also here, above. You can define the **Timezone**.

4.3 Identifying of connecting computers

Open the **Network** / **Hostnames** menu.

Here you can register external connecting network devices / machines, for easier identification.



You can Add logical names to the IP addresses of the connecting machines, which you can see as listed at the **Status / Overview** menu as external connected clients.

When you have modified the settings, save them by the **Save & Apply** button.

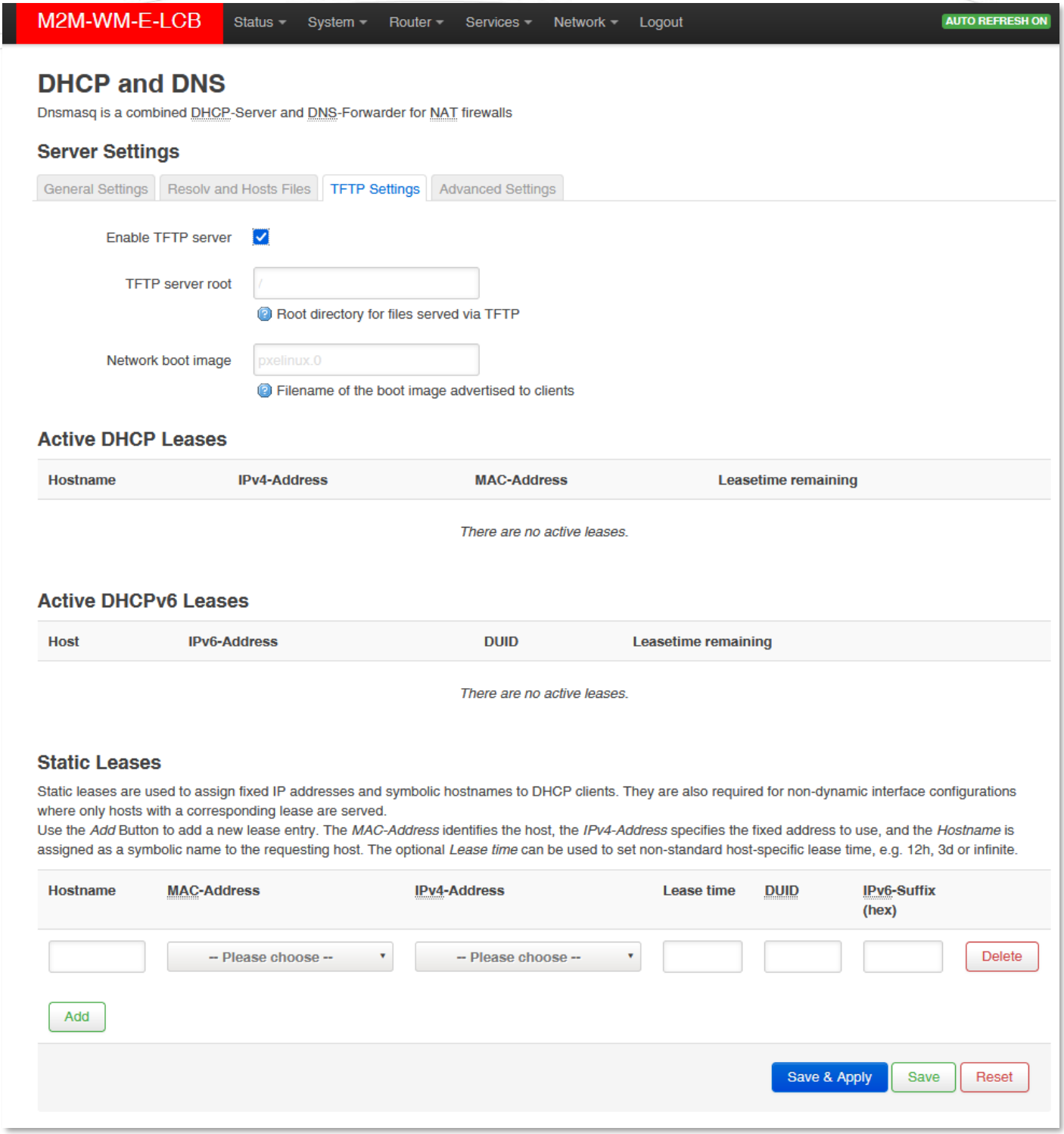
The local hostname for the modem (which name will appear for external devices on the network), it can be changed at the **System** / **System** menu item, where you will find the **General Settings** tab, at the **Hostname** field you can define unique device name – to make it easy to identify the device on the network.

4.4 TFTP settings

Open the **Network** menu, **DHCP and DNS** item.

Here on the **TFTP settings** tab you can enable the TFTP server (**Enable TFTP server**) and enter additional information about it.

The FTP service can be useful for forwarding the data of connected devices via ftp, to a server or remote IP address.



To enable the TFTP server, you must enter the following server information: **TFTP server root, Network boot image.**

Of course, you can also use SFTP on your device by sending the data to IP addresses by entering your account and password information. if you need more help, see Chapter 9 in the OpenSSH Linux command line settings.

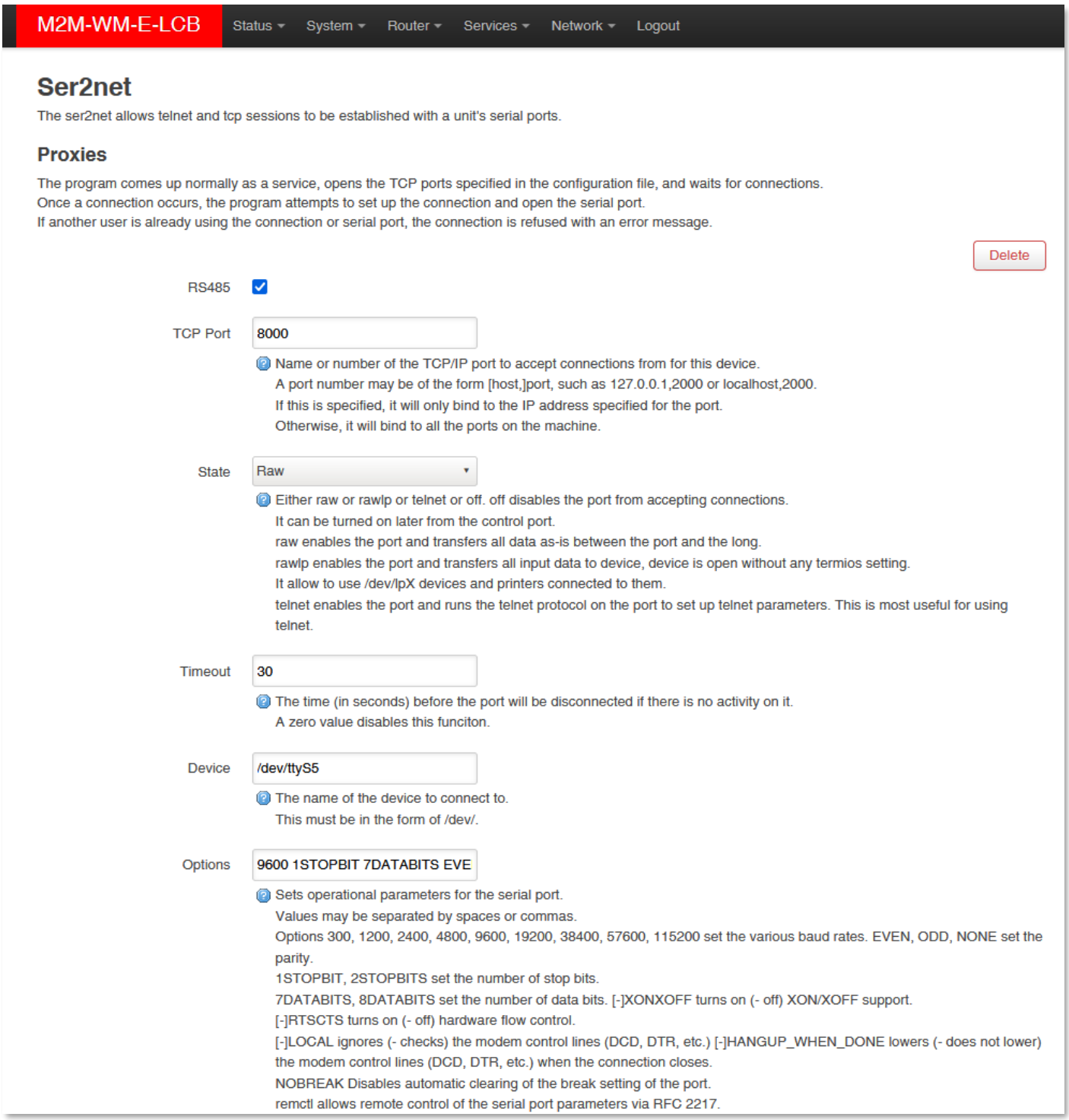
If you have modified the settings, save by **Save & Apply** button.

4.5 Ser2net (RS485 settings)

For the proper settings of the RS485 port connection, choose the **Services** / **Ser2net** menu item.

Here you can define the protocol conversion parameter settings, such as receiving the incoming communication in the proper format and data exchange.

For first, the **RS485** feature must be enabled and RS485 cabling of RJ45 port must be connected to the external device, which you want to get data from or collect data.



TCP Port - nr. 8000 by default, which you have to configure to your needs.

State field - choose the right protocol type here:

- *off*: no dataflow
- *raw*: full duplexity
- *rawlp:* one-direction communication
- *telnet:* for further usage

We offer to use the ***raw*** option here, because the meters are sending raw text format files to the modem.

Timeout – default value is 30 (0 means without delay).

Options: A complex parameter with **Baudrate** selection + **Stopbit** definition + **Databits** definition + **Parity** type

- **Baudrate** (default is *9600* bps for the RS485) can be defined between 300 bps and 115 200 bps.
- **Stopbit** value can be 1 or 2
- **Databits** value can be 7 or 8
- **Parity** value can be EVEN, ODD or NONE

Examples:

For standard speed 7E1 mode use this command: ***9600 1STOPBIT 7DATABIT EVEN***

For lower speed 8N1 mode use this one: ***2400 1STOPBIT 8DATABIT NONE***

Important! *Note that maximum 115 200 baud speed rate can be used wheather of the configuration options.* ***But, we offer to use the standard 9600 baud or 2400 baud speed rate for receiving or transmitting data without character / data loss.***

The incoming RS485 data are not stored locally, they will be transparently transmitted from the device through the cellular network.

Note, that you should add the specified RS485 port number to the **Firewall** rules (**Network / Firewall** menu), otherwise the router will not receive any data.

You can also specify additional members, such as *hardware flow control* with the **RTSCTS**, which can be turned off with the "**-**" prefix. A ***space*** character must be placed between members.

When you modified the settings, save them by the **Save & Apply** button.

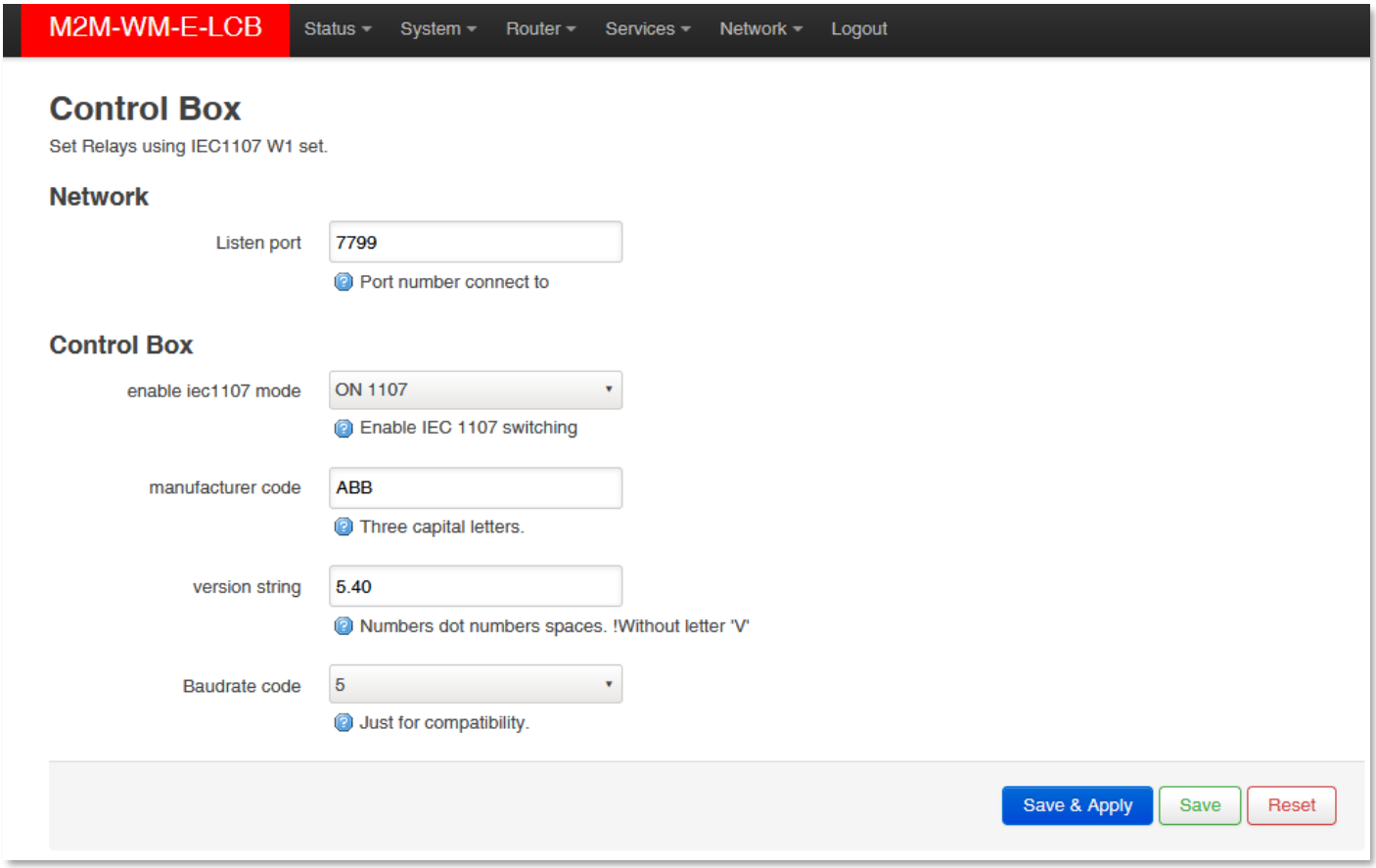
4.6 Relay switch settings

The relay output settings can be achieved in the **Router / Relay Switch** menu.

At the **Network** part, configure the **Listen port** – here you can define a port for detecting the relay switch success, load control box events.

At the **Control box** part you will find the **enable the iec1107 mode** field, which is for protocol compatibility. It has the following protocol conversions to be selected:

- *ON 1107* – IEC 1107 protocol compatible mode
- *OSLP* – Open Street Light Protocol compatible mode
- *ON 1107 + OSLP* – IEC 1107 and Open Street Light Protocol compatible method



Manufacturer code – Usable for further identification

Version string – see the load control box documentation for more

Baudrate code – can be selected from the following standard speed rates:

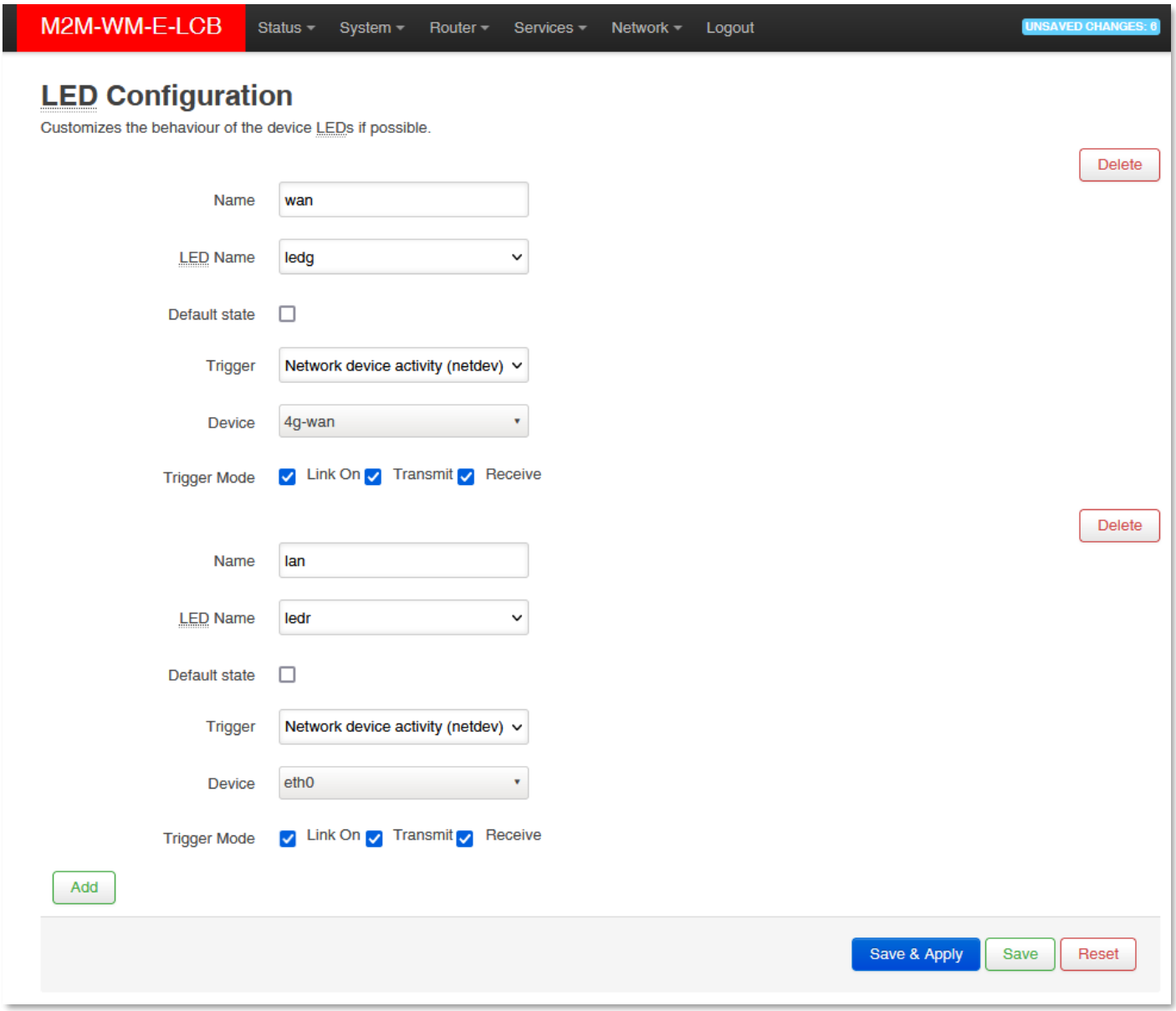
- 0: which means 300 baud
- 1: which means 600 baud

- 2: which means 1200 baud
- 3: which means 2400 baud
- 4: which means 4800 baud
- 5: which means 9600 baud
- 6: which means 19200 baud

When you modified the settings, save them by the **Save & Apply** button.

4.7 LED configuration

The device has 5 LEDs to assign the current relay switch status and network connection. The first 4 relay LEDs are fixed (**REL.1..4**), but the 5th LED - the **WAN** LED (network connection) - is reprogrammable.



The **WAN** LED has a pre-defined default value, but you change its opreation in the **System** / **LED Configuration** menu. There you can define a LED rule for events - as lighting/blinking.

By the **Name** field add a logical name (for identifying the led) and choose a physical led for the setting by the **LED Name** field.

Then declare the event of operation by the **Trigger** field and the interface at the **Device** (which will be valid for). All useable possibilities are listed on the web UI.

The **Trigger** allows to choose an event type of operation. E.g. *netdev* means the network interface connection type, and **Device** identifies the related network interface. Select a **Trigger** type from list, if additional option required then additional menu will appear.

At the **Trigger mode**, the **Link On** (network activity), **Transmit** (data transmitting) or **Receive** (data receive) can be choosed for signing the data flow or activity by he LED flashing.

When you have modified the LED settings, save them by the **Save & Apply** button.

4.8 Using the UCI Command Line Interface

The operating system uses the embedded Micro uClinux, kernel 4.9 version, ***UCI Command line interface*** – check command line compatibility before using the commands here.

The **Unified Configuration Interface** (**UCI®**) is an API of OpenWrt® which is also the utility to intend and to centralize the whole configuration of a device running on OpenWrt®.

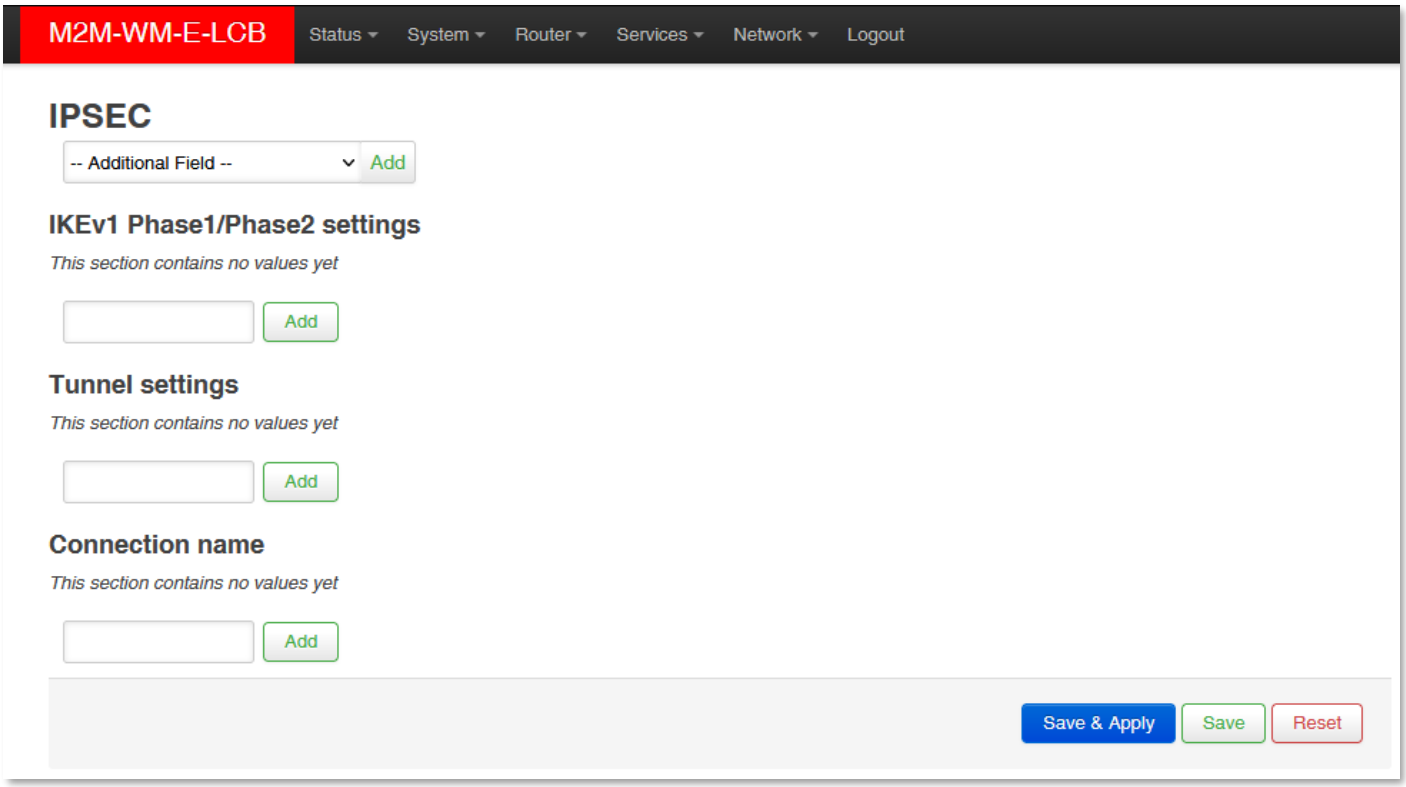
You can find the UCI command line interface options, setting parameters in the UCI® CLI document. Check the *„UCI® Command Line Interface Reference"* documentation for more information of using the *UCI.*
https://www.m2mserver.com/m2m-downloads/UCI_Command_Line_Reference_v3.pdf

4.9 IPSEC settings

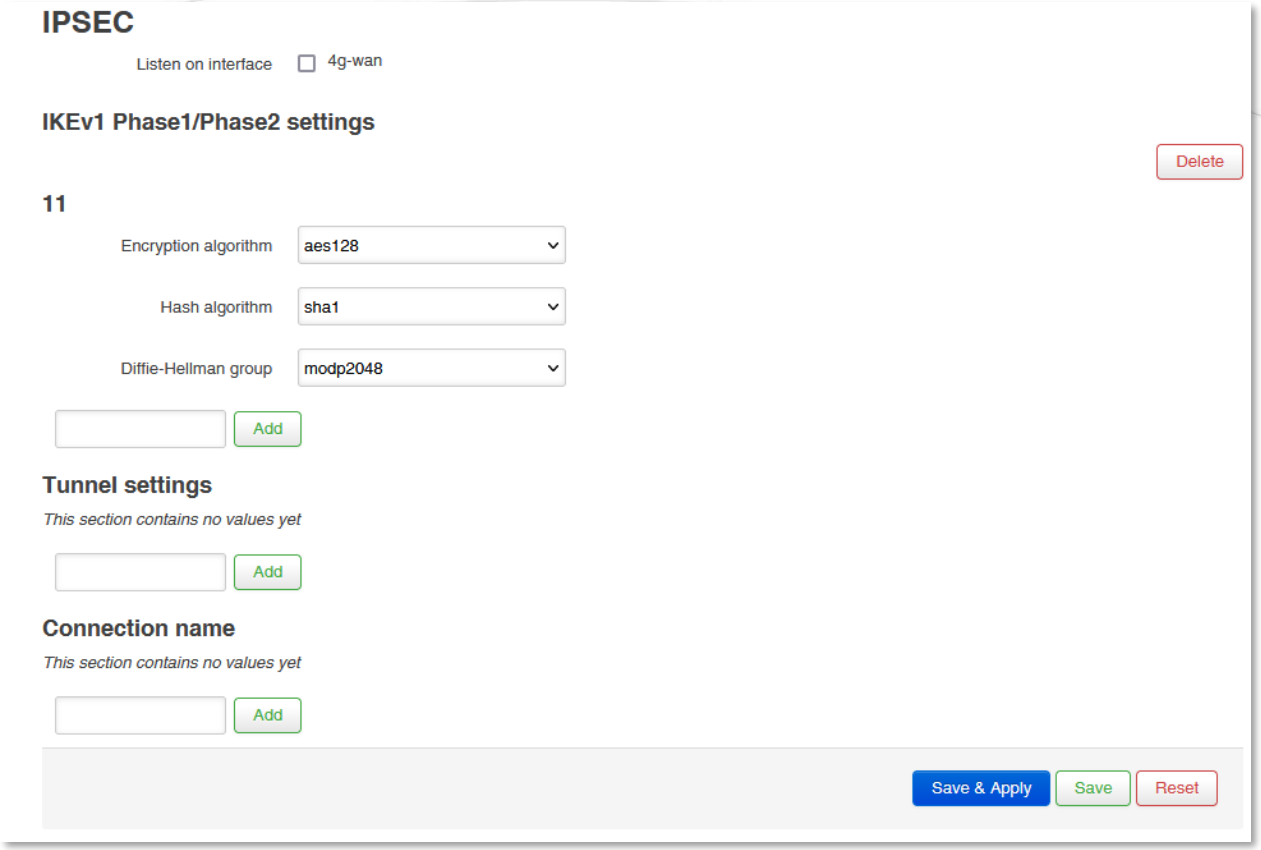
Open **Network / IPSEC** to configure *Strongswan IPSec* settings. In the **IPSEC** section, you can set the Listen on interface option and then press the Add button - the available interfaces will be displayed.

Select one or more interfaces through which you want to use IPSEC.

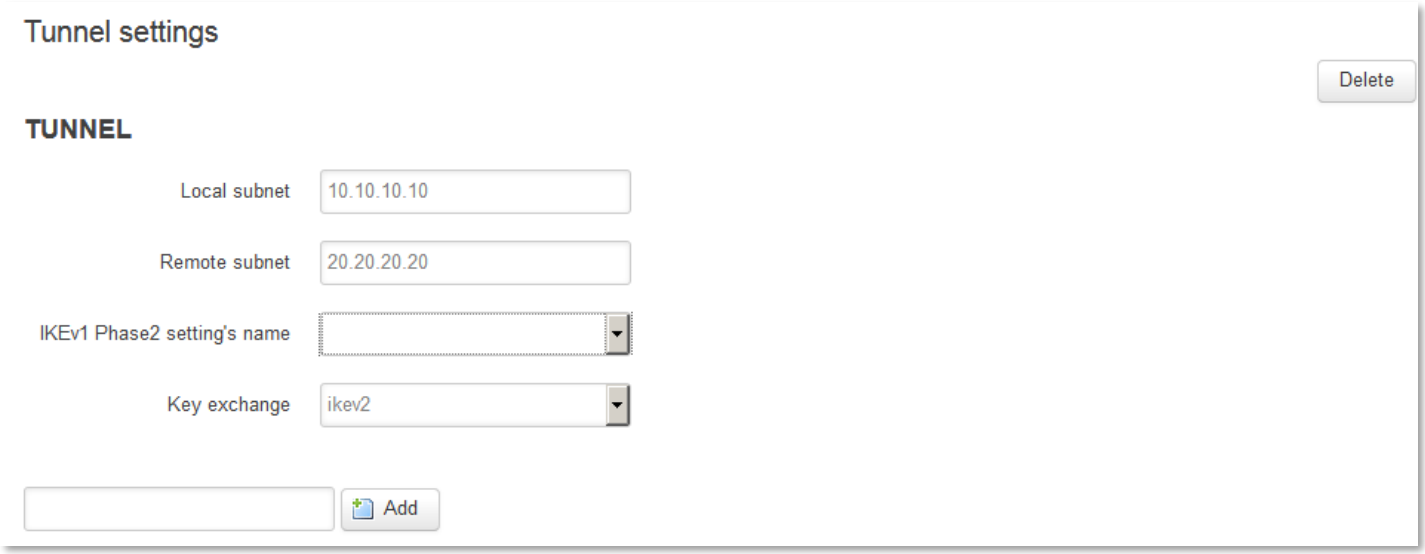
Below, in the **IKEv1 Phase1 / Phase2** settings, you can use the Add button to give a logical name to the **IPSEC connection**, then select the **Encryption algorithm** and **Hash algorithm**, and set the Diffie-Hellmann group to the tunnel.



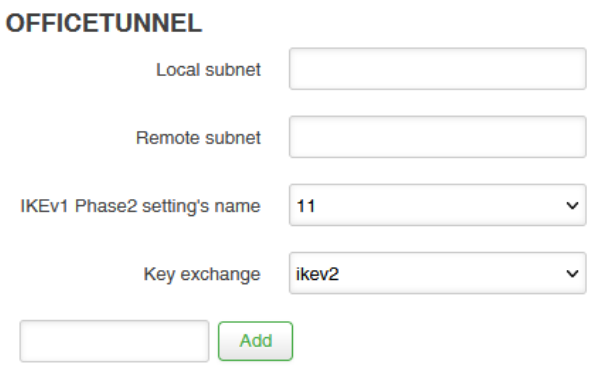
Below, in the **Tunnel settings** section, the Add button can be used to enter the settings for the tunnel by entering a logic name again**. Local Subnet** and **Remote Subnet** indicate the IP address range of the local and remote subnets.



The name of the **IKEv1 Phase 2** option is an optional name where you must specify the **Key exchange** method.



Below, in the **Connection** name section, you can enable or disable the connection (**Enable** / **Disable** connection).



Attention! The IPSEC used by the program uses Strongswan-based IPSec. To learn more about it, visit the OpenWrt page for more information on possible settings: https://openwrt.org/docs/guide-user/services/vpn/ipsec/strongswan/start

Enter **the IP setting** for VPN connection's **remote gateway address**, select **Authentication mode**, and enter the PSK (**Secret or PSK of connection**) key.

IKEv1 connection mode can be main or aggressive.

Enter the keys for the **Local gateway identifier** and the **Remote gateway identifier**.

When you have modified the settings, save them by the **Save & Apply** button.

You can read more about IPSEC settings that can also be set from the UCI (Command Line UCI Command) here: https://oldwiki.archive.openwrt.org/doc/uci/ipsec

IPSEC can also be configured using the Linux-side Strongswan daemon using the UCI - from the command line - using SSH. Some examples of its use:

To query OpenVPN settings:

```
#uci show ipsec
```

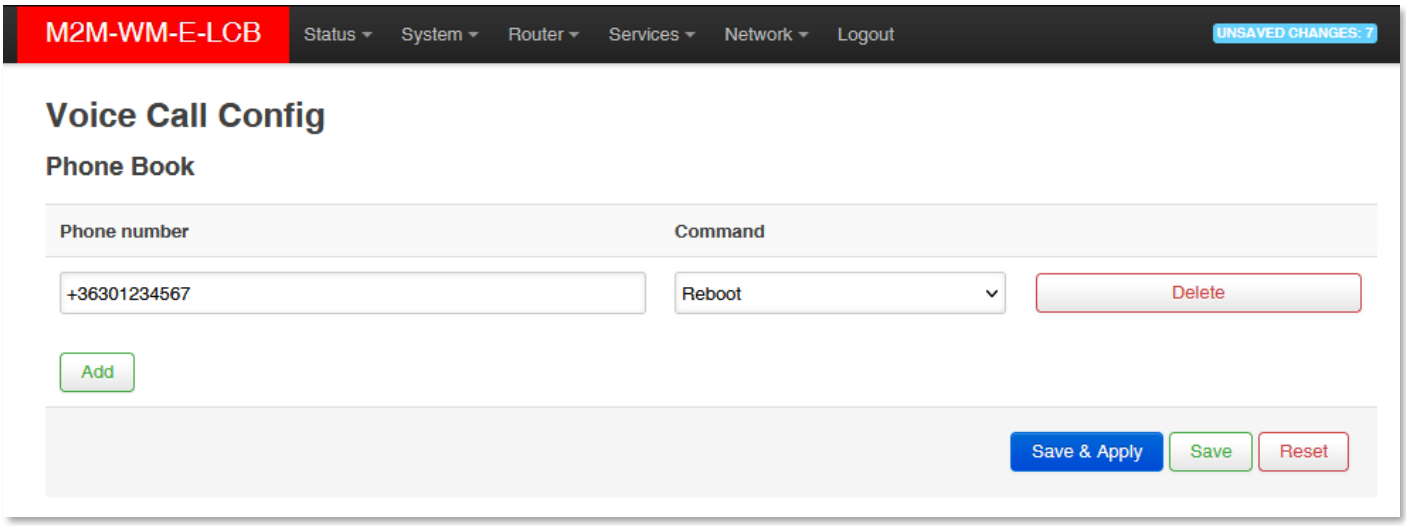
For this, the current IPSEC settings are displayed on the command line.

Configuration by the following syntax. Then you have to commit.

```
#uci set ipsec1.encryption_algorhitm='aes128'

#uci commit
```

4.10 Voice call settings

You can set remote reboot commands in the **Network / Voice Call Config** menu.



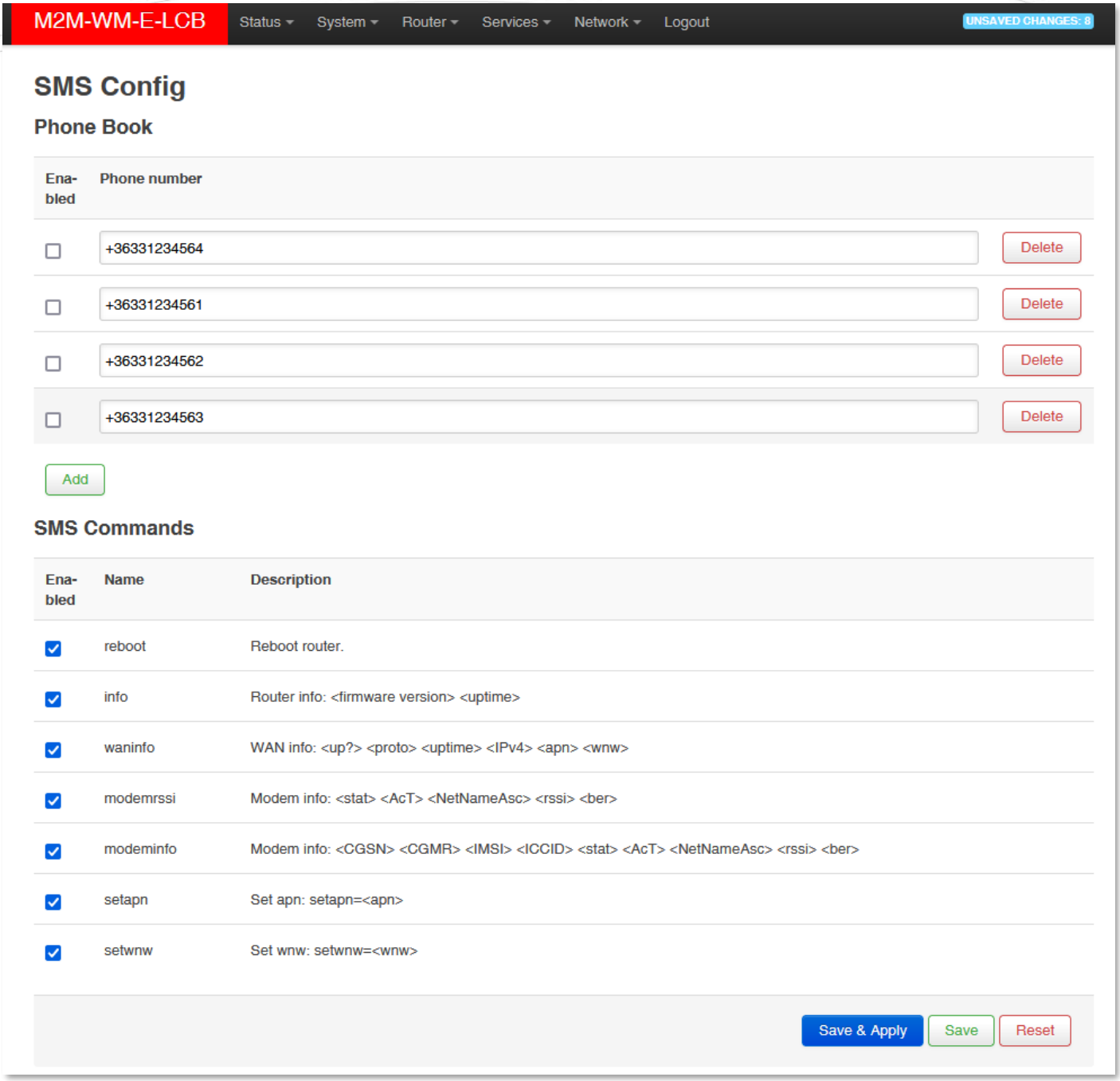
For an incoming call from an allowed / assigned phone number, the device runs a *reboot* command.

You can also use the Add button to add additional phone numbers and select the *reboot* command for the phone numbers.

Press the **Save & Apply** button to save the settings.

4.11 Run commands remotely (SMS config settings)

You can execute commands on the device remotely when an SMS message is sent to the device SIM card's phone number. To set these remote control commands, open **Network / SMS Config** menu.



First you can see the **Phone Book** where you can define or Add phone numbers.

Then you have to **Enable** the selected phone number.

At the **SMS commands** part you can choose preset commands by selecting them for the number.

In the case of an SMS from a preset phone number, the device runs the preset command (s) assigned to the phone number: e.g. **Reboot**

For other commands, the device returns the information in a reply SMS message (e.g. when sending the "**info**" command in SMS, the device sends the firmware version number and the elapsed time since the last boot info to the phone where the SMS has been sent).

When you have changed something, press the **Save & Apply** button to save the settings.

Chapter 5. Maintenance

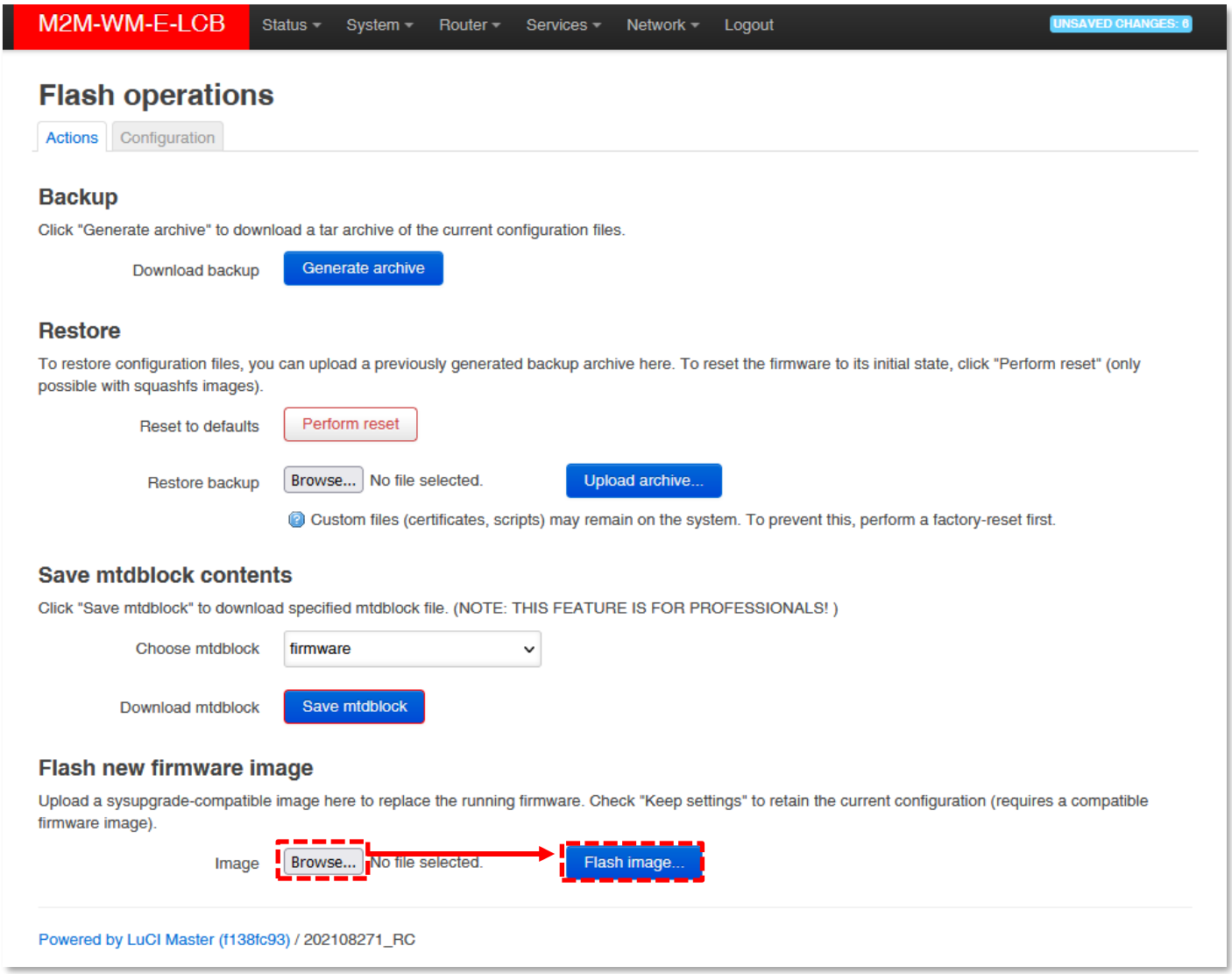
5.1 Firmware refresh

1. Download the latest device firmware from our website by the following URL:
   https://www.m2mserver.com/m2m-downloads/fwos-BE0080x_WM-E_LCB.202204281_RC.tar.gz

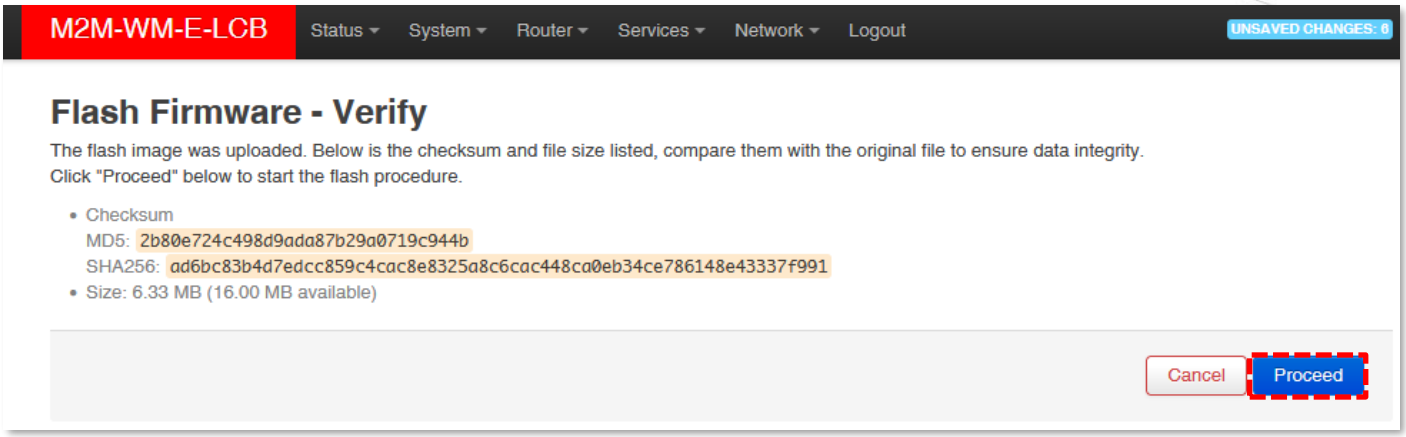
2. Open the **System** menu, **Backup / Flash Firmware** menu item.

3. At first just by safety, **backup your system** before changing the firmware version (see the instructions later).

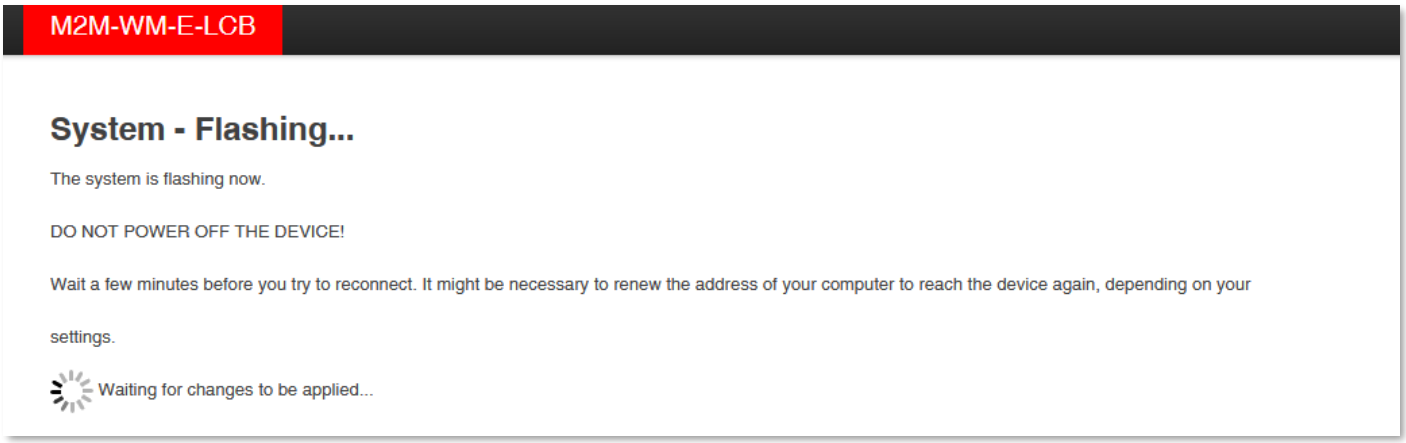
4. Push the Browse... button for selecting the compressed and downloaded firmware file (***fwos-....*** file with **.zip** extension) from your computer, then push to the Flash image... button.



5. After the compressed firmware file upload to the device, a new window will appear where the uploaded file is checked. Then you can start the system software refresh by the **Proceed** button.



6. Then another message appears on the screen in the browser, that he refresh method has been started.



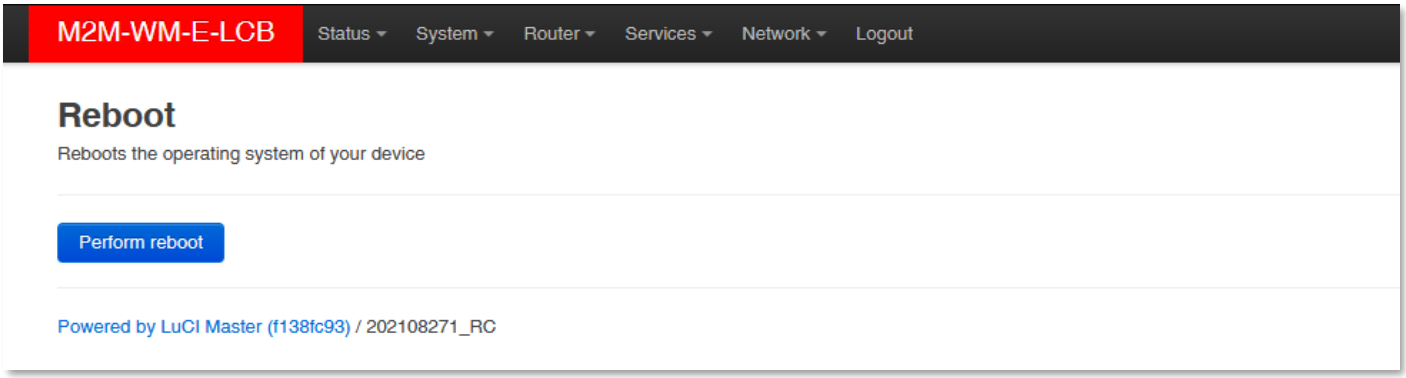
7. All network connections will be disconnected during the installation.
   When the firmware installation begins, the **WAN** LED will assign the installation, which will be continously blank until the finish of the installation. The firmware refresh requires about 2-4 minutes.

Note, that the signals of relay LEDs will be not changing during the firmware update.

8. At the end of the installation, device will be restarted automatically, which will be signed by the short **WAN** LED activity. All further operation / LED signals will be the same as it is written in the Installation Manual, Chapter 2.2.

5.2 Restarting the device

The device can be restart from the LuCi web user interface, from the **System** / **Reboot** menu, by pushing the Perform reboot button.



Then the device will disconnect the **LAN** and **WAN** network interfaces, which will be signed after 5-10 seconds by the blank **WAN** LED.

Then the device will be restarted, and after ~1-2 minutes the network interfaces will be available again, which will be signed by the active **WAN** LED.

5.3 Turn off the device

The device can be turned off by removing the power wire (No. 5) from the AC plug. The device will be turned off safely. It will disconnect the **LAN** and **WAN** network interfaces, which will be signed after 5-10 seconds by the blank **WAN** LED.

After ~10 seconds all the four LEDs will be blank, which is signing that the device is not powered by the AC voltage further.

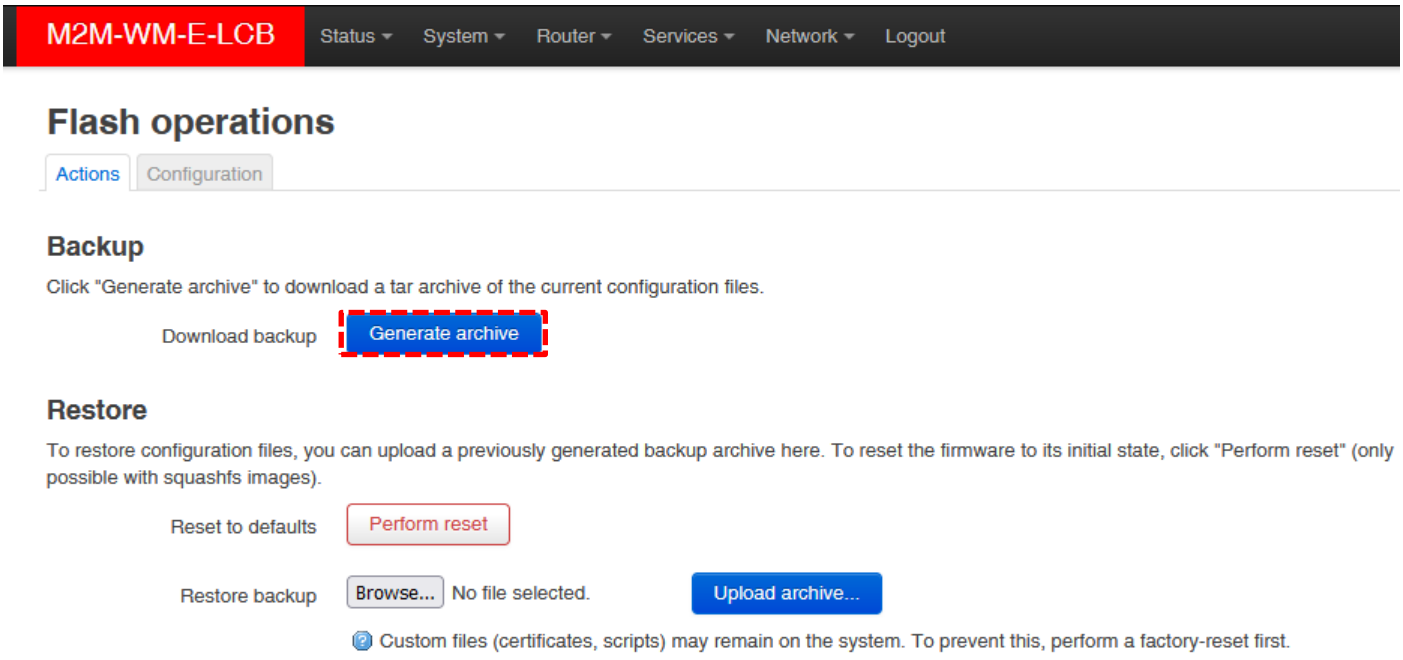
REL.1		REL.2		REL.3		REL.4		WAN	

IMPORTANT!
THE AC POWER INPUT WIRES ARE STILL CONNECTED TO THE DEVICE. THEREFORE DO NOT OPEN THE DEVICE ENCLOSURE UNTIL NOT REMOVED THE AC POWER FROM THE PLUG OR THE POWER SOURCE!

The device can be started anytime again by adding the power source for the device (connect the AC power plug to the electricity network). The device will be operating as it is written in the Installation Manual, Chapter 2.2.

5.4 Backup device settings

The modem settings are automatically stored by the OpenWrt® system, but there can be other situations when you need to restore the settings to a previously saved settings. You can save these settings to your computer or restore back to the modem anytime by following the next hints.
Open the **System** menu, **Backup / Flash Firmware** menu.



To backup your system settings into an archive file, choose a the **Backup / Restore** part, the **Download backup** and push to the Generate archive button. It is saving current settings to a compressed file to your computer. This is very useful during the first configurations.
A pop-up message will apear to save the archive file to your computer. **Save** the file, please.

Important!
After the next reboot, the system will starting the system by these stored settings – as the new default configuration.

Note that the modem saves its own settings and components only! If you were installing 3rd party applications or installing and using your own scripts, the system WILL NOT BACKUP these and these are not part of the compressed backup file! You must save the additional files, scripts and directories manually by your own.

You can include or exclude your files and directories in your backup process by using the **Configuration** tab here. You can edit the list with all necessary directories you need.

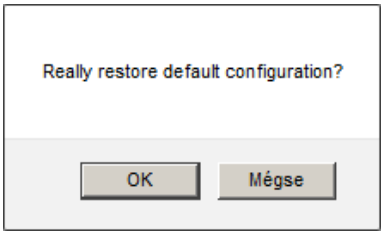
Of course, you need to know the modem device's file system to make it right. Therefore, we offer to check the OpenWrt® system structure, directories by standard Linux-side commands from the CLI.

When you are ready with the modifications, push the Submit button for the changes.

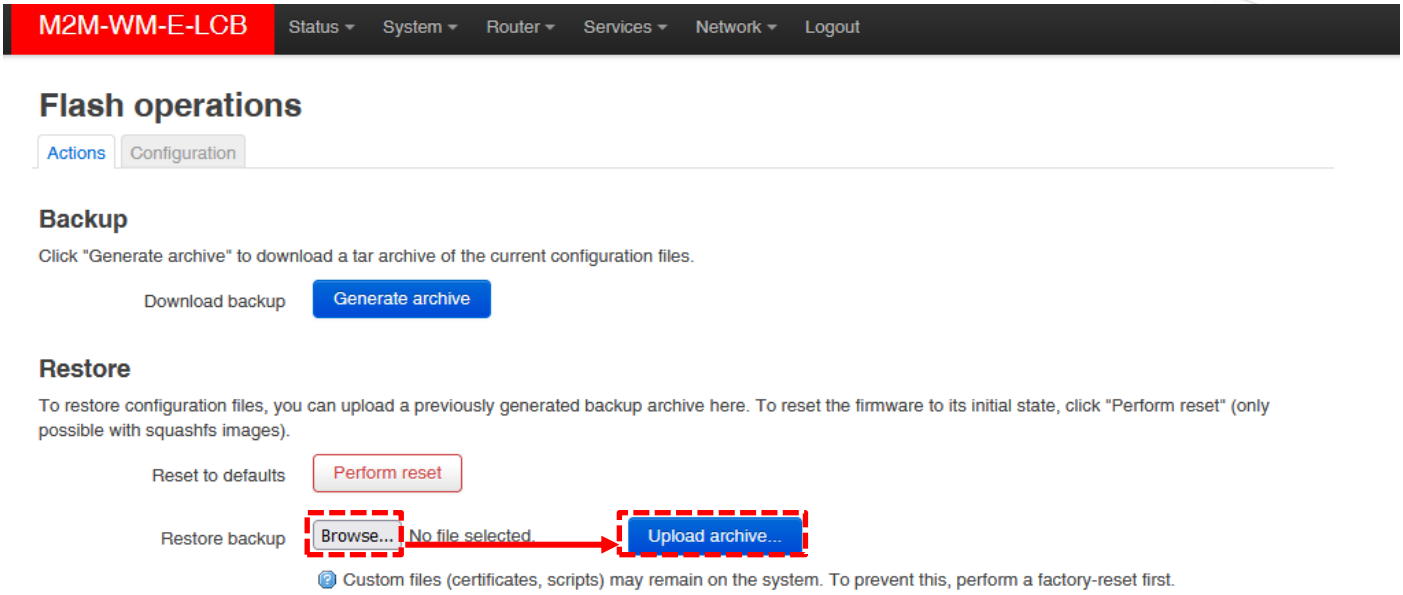
5.5 Restore device settings

For making a **complete restore** from your computer (.tar.gz. format) of the device, open the **System** menu, **Backup / Flash Firmware** item.
Here you can restore your previously saved system configuration archive – as a saved last good know configuration.

For this, just push the Browse... button at **Restore backup** option and choose the previously saved archive file (tar.gz extension compressed file) from your computer. Then push to the Upload archive... button.



Then a popup window will appear, where push **OK** if you want the restore the default configuration.



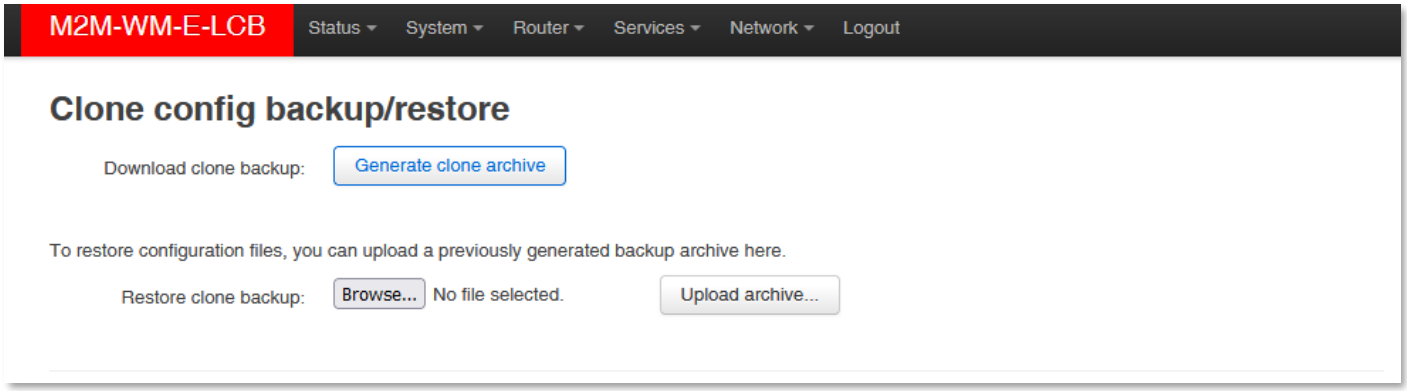
Then the system will reload the saved backup and restore the settings to the device. Afterall the device will restarted by the system and applying the previously used configuration.

Important!

Note that your custom saved settings must be loaded seperately – it won't be restored automatically.

5.6 Clone config backup/restore

The device current configuration settings can saved (backup) and strored by the **System** menu, **Clone config backup / restore** menu item.



To backup your system settings, push the Browse... button to define the path/directory to save the file and push to the Generate clone archive button.

A pop-up message will apear to save the archive file to your computer. **Save** the file, please.

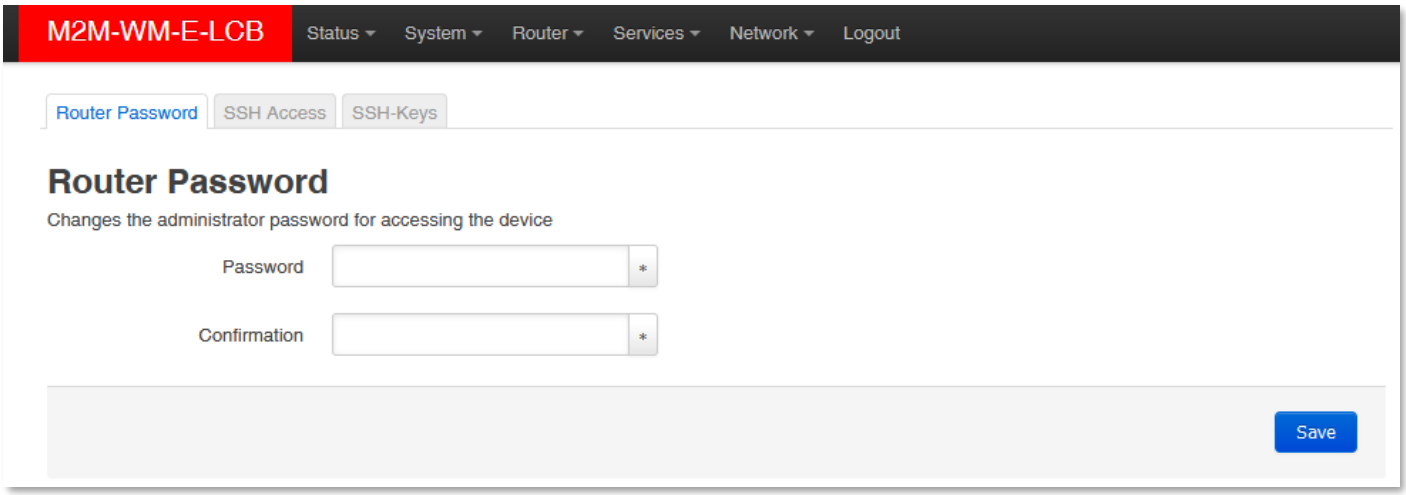
This is very helpful to move the saved configuration file to your computer and then later restore these settings to a different modem device by the **Browsing...** and then the Upload archive... button. There you can save time by this quick configuration method.

Chapter 6. Administration

6.1 Password change

Open the **System / Administration** menu.

At the **Password** part you can fill the new **Password** and repeat it the at the **Confirmation** field.



IMPORTANT NOTES

- The password must contain min. 8 characters, lowercase and uppercase letters and numbers or special characters are allowed.
- It is obligatory to use passwords by using minimum 3 special characters (upper case, numbers or special characters (e.g. underline)
- The currently used **Password** cannot be seen here due to some security rules – the characters shown as are empty here.
- When you are changing the password, the written characters will be placed by asterix (*) substitute characters.

When you have modified the settings, save them by the **Save & Apply** button. Now you can login with the new password.

Note, that the **SSH Access** can be reconfigured here as the **SSH Keys** can be defined also.

6.2 Logging

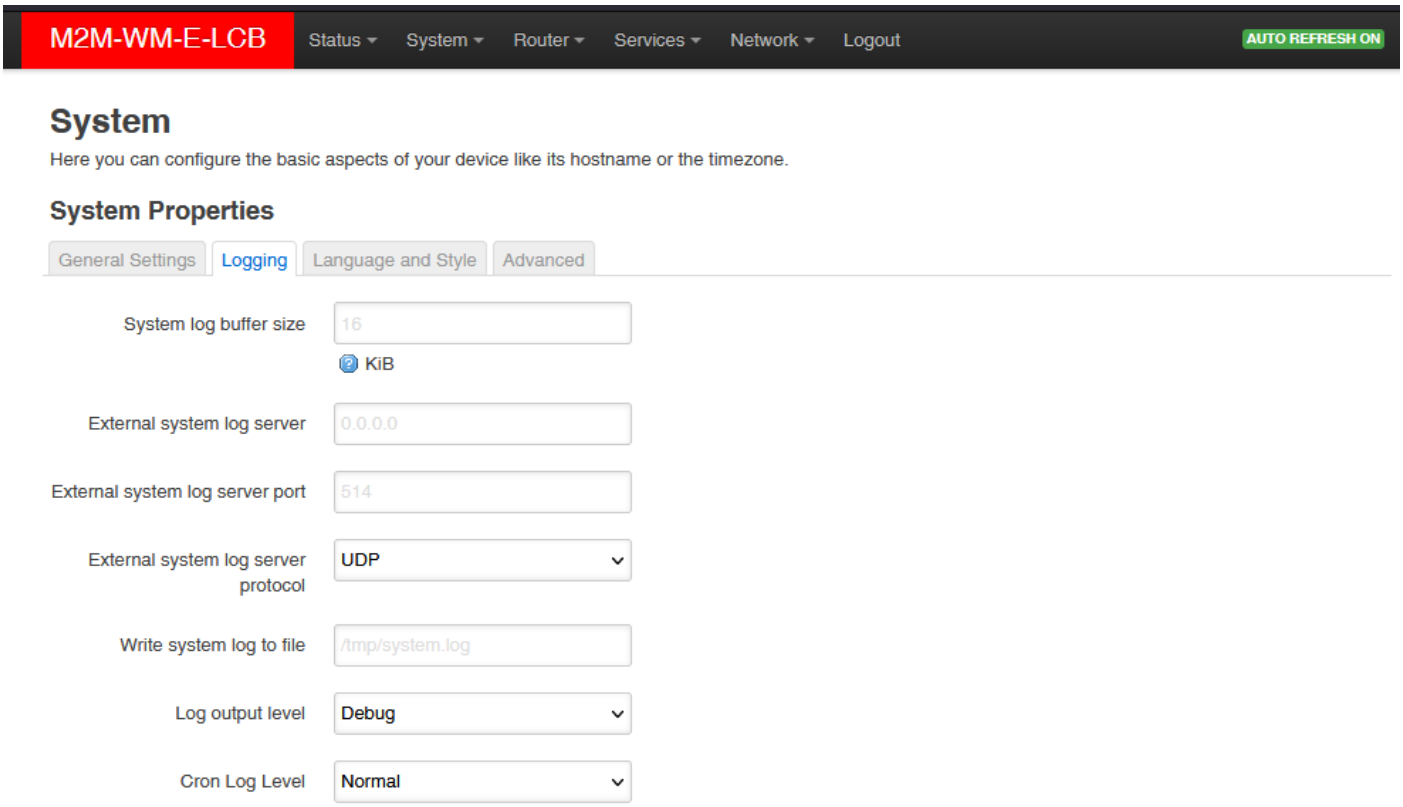
Open the **System / System** menu find the **Logging** tab.

You are able to limit the log file size (**System log buffer size**), and you can define an **External system log server** (IP address) and its **port, protocol** for sending the log files for a distant IP address.

There you can define a log file (**Write system log file**) and the level of logging (**Log output level**).

The **Log output level** can be also defined for the added log file (**Write system log to a file**) – filename should be added with directory path.

When you have modified the settings, save them by the **Save & Apply** button.



Remember that you can use further log features from the **Status** menu, where the **System log**, the **Kernel Log** helps you to understand what is happening on the modem currently since its last reboot, you also can check the proper operation at these menus.

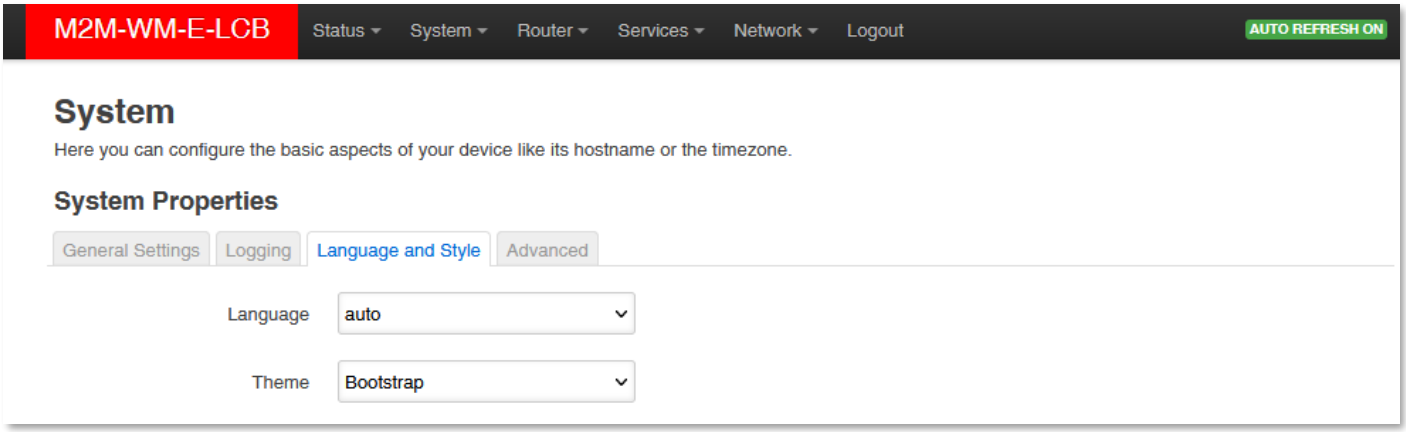
There are other log files generated by default that we have already mentioned in part. These include the **System log** and the **Kernel Log** file in the **Status** menu, which help you understand what has happened during operation since the router was last rebooted. This can be especially useful when detecting an error.

6.3 Language settings

Open the **System / System** menu find the **Language and Style** tab.

Here you can choose a pre-defined **Language** for the web user interface by selecting an item from the list.

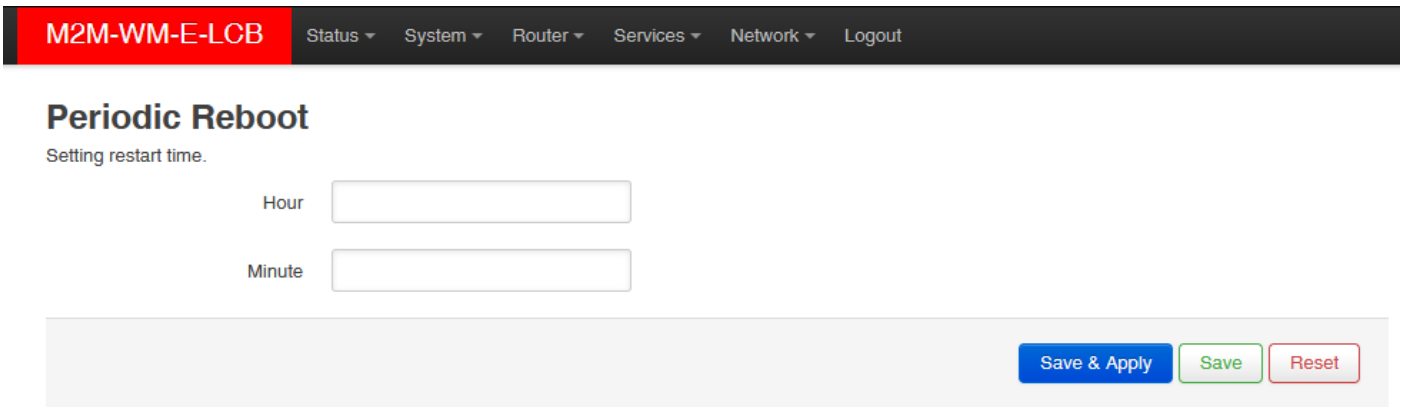
The *Auto* preference means that the OpenWrt® UI language will be configured according to your browser language settings.



Push to the **Save & Apply** button when you have changed the language, then the new language translated texts will appear.

6.4 Periodic reboot settings

For matching the industrial standard requirements, you can define an time interval for periodic daily restart of the deivce if you want in the **Router** / **Periodic Reboot** menu.

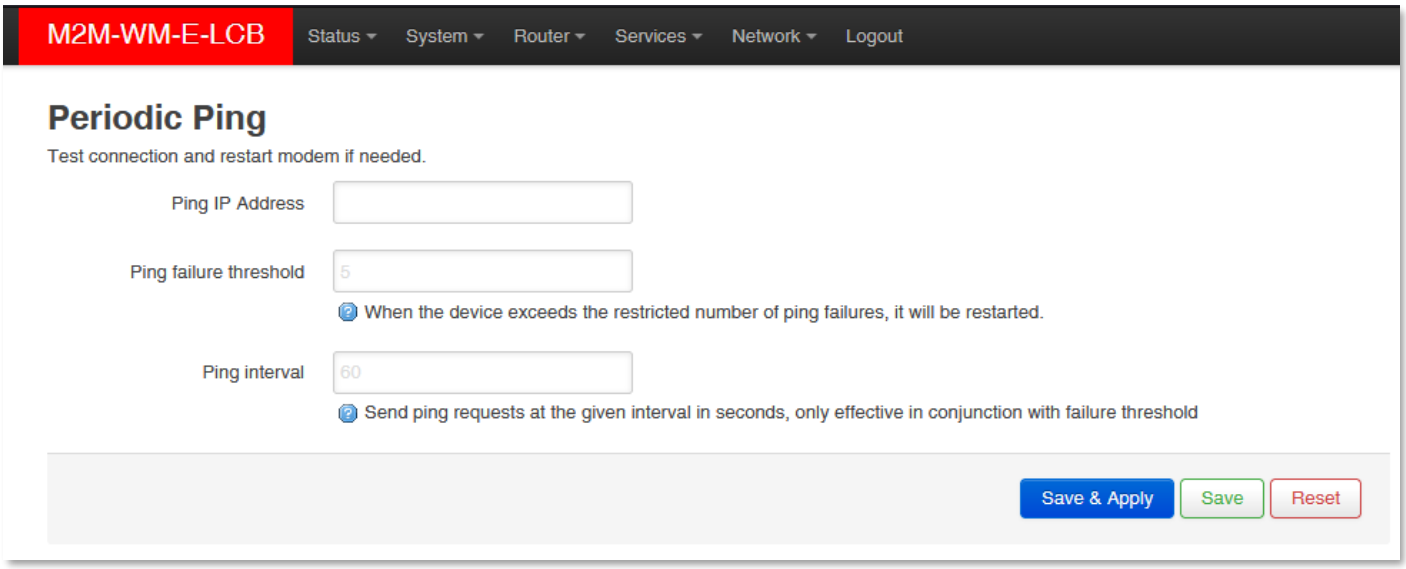


At the **Hour** and **Minute** values, you can define the daily HH:MM period to be applied for the device reboot.

Save your settings by the **Save & Apply** button.

6.5 Periodic ping

If you want to use periodic ping for checking an IP address or remote server, device as checking its availability by the device if you want to use this service by the **Router** / **Periodic Ping** menu.



Ping IP Address – define the IP address to be progress the ping command.

Ping failure threshold – ping failure numbers to be ignored (e.g. in case of 5, which means 5 errors for a ping interval is normal, not signed as a fail/error).

Ping interval – length of ping running in seconds (e.g. 60 means ping for 1 minute).

Save your settings by the **Save & Apply** button.

6.6 Installing 3rd party applications

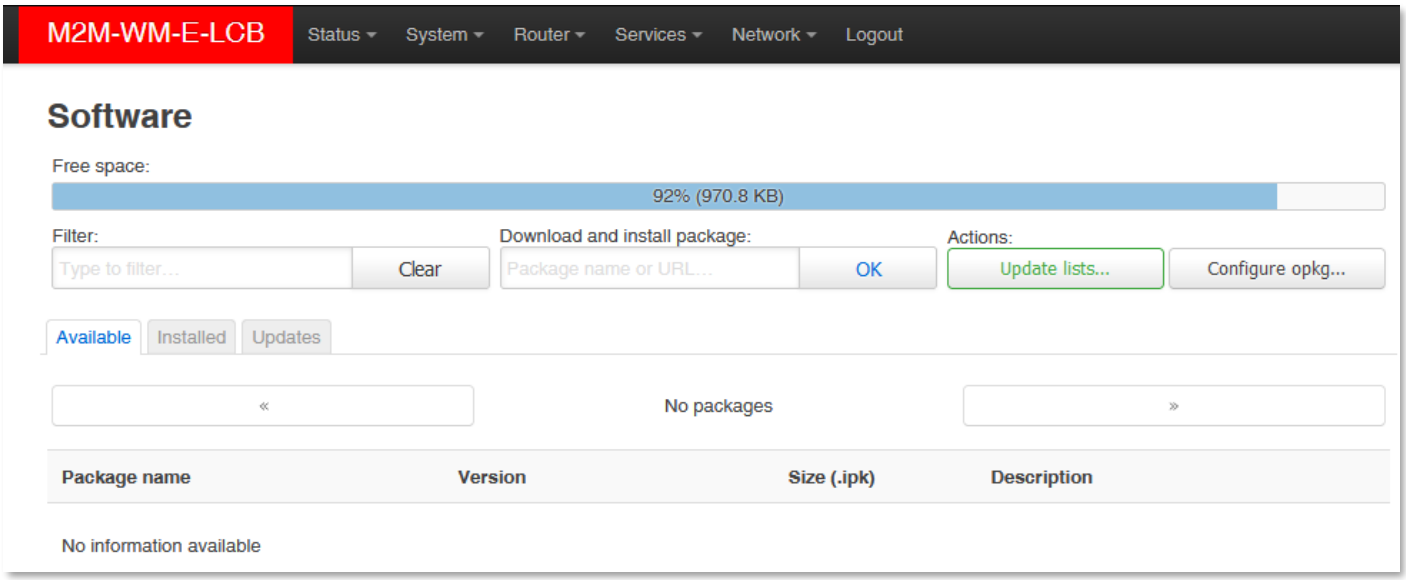
Open the **System** / **Software** menu.

The installation software repositories can be defined at the Configure opkg... button). Save the repository settings by the Save button.

Push to the Update lists... button to refresh the available software catalog from the configured software repositories.

Then choose one or the name of the application, which you are attempted to install to the **Download and install package** field.

If you want to select the file, then use the **Filter** field and enter the program name you are searching for.



E.g. fill the *„mc"* - which means the *Midnight Commander* application – to the **Download and install package** and push to the **OK** button.
Then the package will be installed and afterall the installed package will be listed with its Version. Now you can use the installed Linux application / component.

Open SSH terminal window to configure your new application or use it. E.g. about our example, enter the „mc" to start the *Midnight Commander* tool which you were installed from the repository.

> ***Important!***
> *Note, that this feature is available only, when the public Internet is accessable by the SIM card and the used APN.*

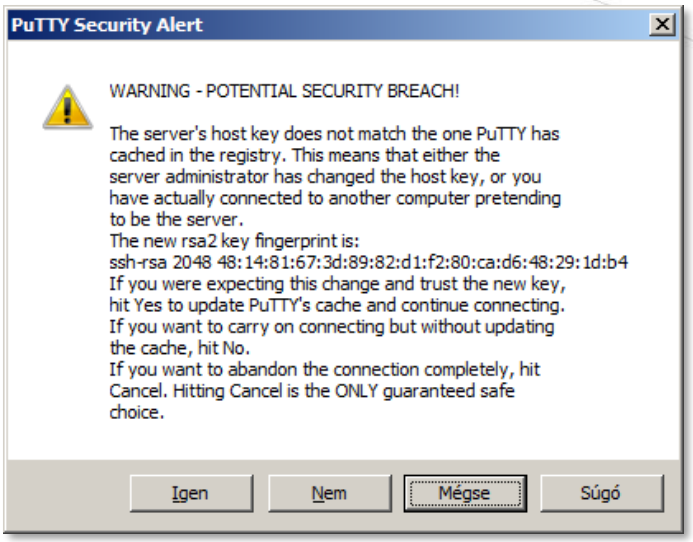
6.7 SSH access

You can access the device remotely according the current settings. Consider, the device can access external devices or data due to the SIM card IP-segment possibilities.
The same issue when you are attempted to access the device remotely: your computer must be located in the same IP segment or APN zone as the modem has. (In case of public internet access, there is no limit for that.)

The remote access is possible by SSH and FTP service.

SSH Connection

The device can be accessed through SSH connection, when it is available on its IP address – by a terminal utility (e.g. *putty*) – at the **192.168.127.1:22** (port nr. 22 – **LAN** interface).



Accept (Yes) the Putty or other SSH terminal's Security Alert of the RSA2 key of the device to allow and trust the connection – by security reasons.

SSH login data:

Login: ***root***

Password: ***wmrpwdM2M***

Now you are logged in, at the OpenWrt®'s command line.

Here you can use Linux commands or using scripts or the ***uci*** commands on the device. (Check chapter 4.8 for more information about the *UCI®*.)

6.8 Device Manager® settings

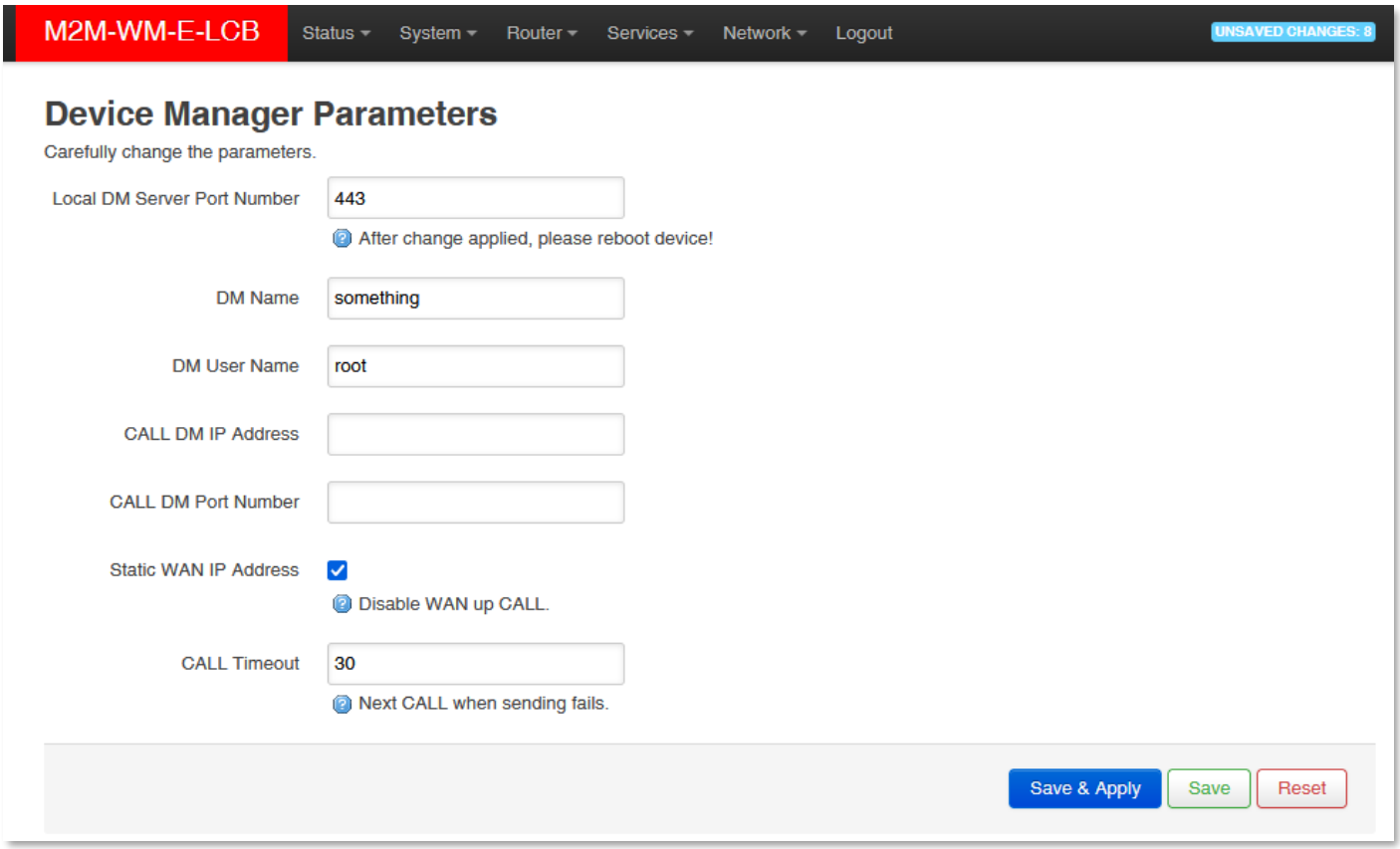
Our Device Manager® application can be used for the remote management of the load control box (WM-E LCB device), which is used for the remote maintenance and reconfiguration of the device in addition to the continuous monitoring of the operating characteristics (network access, field strength, runtime, QoS).

In addition, it is possible to replace and install the firmware running on the device. You can manage hundreds of load control box devices from this software in this way.
The requested settings can be made individually or for a group of devices in one step.
To use the application, you need to purchase a license, please contact our Dealer.
More info: https://m2mserver.com/en/product/device-manager/

The *Device Manager* settings can be defined in the **Router / Device Manager** menu.

The main importants are the **DM IP Address**, the **DM Port Number** and **DM User Name**.

The default DM Port number is **443**.



These must be also configured in the Device Manager® software for the proper operation.
The WM-E LCB device must access the IP address of the Device Manager® server (where the application is executing remotely).

You can check that it is accessed by performing a ping.
If you modified the settings, save them by the **Save & Apply** button.

Chapter 7. Troubleshooting

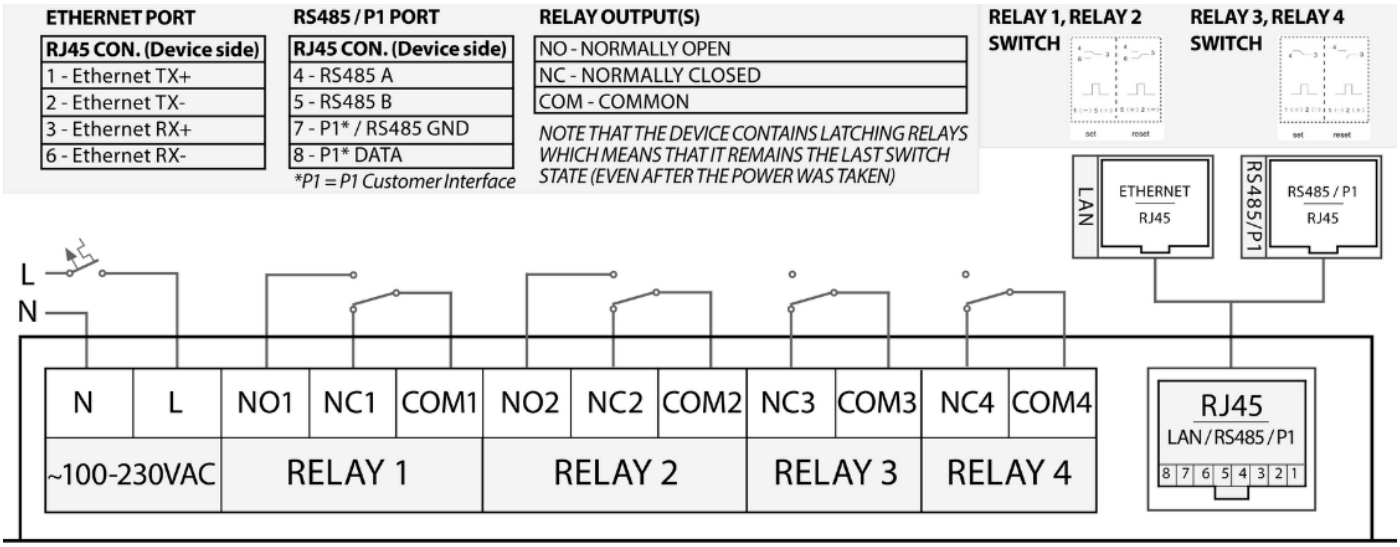
LED signals / LED activity

For understanding the LED activities, please check the *Installation Manual*, Chapter 1.10.

Connecting relays, power input, RJ45 connection

Read the *Installation Manual*, Chapter 1 for more information.

CAUTION! Take care, the device uses ~100-240V AC power source! Only a certified expert persons are allowed to open the device's enclosure or modify the wiring.



SIM-card is not detected

Ask you Mobile Operator about the SIM card is healthness and activation, APN.

SIM/APN failure

Always check the **Status / Overview** menu first at the **SIM ID** field for the current status of the SIM card. In normal case you have to see the SIM identifier there. But, in case of a problem, the SIM error message will be shown, as:

- **No SIM or SIM error –** means: there is no SIM card presented, insert an active SIM card, not inserted properly or the SIM card is wrong. ***Ask the Installation expert person!***
- **Not enough RSSI value** – means: Antenna problem. ***Ask the Installation expert person!***

- **No NW registration** – means: APN name for the SIM card is not configured well or the setting is wrong. Consult with your mobile oprerator and reconfigure the SIM **APN**, username and password on the LuCi® web user interface.
- **Check RSSI** – Antenna or SIM trouble. ***Ask the Installation expert person!***

WAN LED is inactive

If during the operation, when the **WAN** LED is not lighting for long, then the device cannot be registered to the cellular network or the cellular module was not initiated properly. This could also caused by a wrong APN setting.

If the problem is still occuring, ask you Mobile Operator about the SIM card is condition and activation status, correct APN name and configure the modem with the new information.

If it does not help, ***ask the Installation expert person!***

Cannot access the device on SSH / LuCi web interface

You tried a wrong IP address or you cannot connected to the device properly.

Check the IP address, ping the device. If it is still not working, reconfigure the IP address on you PC (IP: 192.168.127.100 / Subnet mask: 255.255.255.0).

For accessing the device's web user interface we offer to use the *Mozilla Firefox* web browser.

Try to access the modem on its USB interface by your browser: https://192.168.127.1:8888

Ensure that the **APN** was already configured and the **WAN** led is active or not.

- Username: ***root*** / Password: ***wmrpwdM2M***
- Push to the **Login** button to access the web UI.

8. Support

If you have any questions concerning the usage of the device, contact us at the following contact:

E-mail: iotsupport@wmsystems.hu **Phone**: +36 20 3331111

Online product support can be required here at our website:
https://www.m2mserver.com/en/support/

For the proper identification of your device, use device's glued sticker and its information, which contains important information for the call center.

Due to the support questions, the product identifier is important for resolve your problem. Please, when you are attempting to tell us an incident, please send us the IMEI and SN (serial number) information from the product warranty sticker (located on the front face of the product housing).

The documentation and software release for this product can be accessed via the following link:
https://m2mserver.com/en/product/wme-lcb/

GNU/Linux license and open source code

The modem's operating system and OpenWrt®/Luci open source code is available on our website at the product site. The software of the device is under GNU/Linux licensing.

9. Legal notice

The pictures in the user guide are only for illustration purposes.
WM Systems LLC. does not confirm or accept responsibility for any mistakes in the information contained in the user guide.
The published information in this document is subject to *change without notice*.
All data contained in the user guide is for information purposes only. For further information, please, contact our colleagues.

Warning

Any errors occurring during the program update process may result in failure of the device.