D2412 B.One Gateway outdoor 16 userguide v1.04

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1.04	Release	Change of the APN settings	Koa	2025-Nov-04

References

No.	Description	Filename	Remarks

ZENNER

Table of content

1. Introduction

1.1 Purpose of the Document

This user manual provides guidance for the setup, configuration, and administration of the ZENNER B.One Gateway outdoor 16. It is designed to support system integrators, field engineers, and technical administrators in deploying the gateway within smart city environments and metering infrastructures. The documentation covers both the physical installation and software configuration using OpenWrt-based interfaces.

Note: This document is not a complete product specification and does not represent a formal performance declaration. It is provided "as is" and will be updated as system features evolve.

The detailed user guide can be found at https://openwrt.org/docs/guide-user/start

1.2 Target Audience

The manual is intended for system integrators and technically skilled users who are responsible for integrating ZENNER gateways into local or cloud-based readout systems. The intended users are expected to have:

- An understanding of IP networking
- Familiarity with Linux-based systems and OpenWrt
- Basic knowledge of LoRaWAN architecture and IoT protocols
- Experience with tools like SSH, SCP, and terminal editors (e.g., vi, nano)

1.3 Scope

The manual covers:

- Hardware setup (SIM insertion, RJ-45 connection, LED meanings)
- First login and access to the LuCI web interface
- Network and firewall configuration
- LoRa packet forwarder and basic station setup
- UCI-based system adjustments
- System recovery and firmware updates

It does not cover:

- Backend LoRaWAN server configuration (e.g., TTN setup)
- Device-specific integrations or customer backend implementations

1.4 Device Summary

The ZENNER B.One Gateway outdoor 16 is an industrial-grade communication gateway designed for outdoor use. It supports LoRaWAN wireless communication and cellular backhaul (via LTE), making it suitable for:

- Smart city deployments (e.g., air quality, parking, lighting)
- Utility metering (e.g., water, heat, smoke, room sensors)
- Private and public LoRaWAN network coverage

It features:

- Dual Semtech SX1302-based LoRa modems
- External LTE and LoRa antennas
- Power over Ethernet (PoE) support
- OpenWrt-based Linux OS for full software flexibility

1.5 Document Maintenance

This document is maintained by ZENNER International GmbH & Co. KG and may be updated without notice. Please check the ZENNER website for the latest version.

2. System Overview

2.1 Device Description

The **ZENNER B.One Gateway outdoor 16** is a ruggedized gateway designed for outdoor deployments in smart metering and smart city environments. It serves as a bridge between local LoRaWAN-enabled devices and centralized network systems, offering reliable wireless data transmission and flexible network integration.

Key hardware features include:

- Two independent LoRaWAN concentrators based on **Semtech SX1302**
- **LTE backhaul** for remote data transmission
- **PoE (Power over Ethernet)** support for simplified installations
- IP-rated outdoor enclosure for extended environmental protection
- Onboard Linux system based on **OpenWrt 23.05**

This architecture enables the gateway to forward sensor data from water meters, heat meters, smoke detectors, and environmental sensors to cloud platforms or central LoRaWAN network servers.

2.2 Typical Applications

The ZENNER gateway is suitable for a wide range of smart infrastructure scenarios, such as:

- **Smart Metering**:
  - Transmission of consumption data from heat, water, or gas meters
  - Integration with cloud-based platforms
- **Smart City & Infrastructure Monitoring**:
  - Air quality monitoring
  - Waste management
  - Smart parking systems
  - Room occupancy and building management sensors
- **Private LoRaWAN Networks**:
  - Use in closed metering infrastructures where public networks are not desired

2.3 Architecture Overview

The device architecture is built for performance and modularity. The main system components include:

Component	Description
LoRa Modems (x2)	Semtech SX1302 concentrators, configurable individually
LTE Modem	Enables cellular backhaul using standard mini-SIM (APN configurable)
OpenWrt OS	Linux-based operating system with full access to LuCI and UCI tools
LAN/PoE Interface	RJ45 Ethernet port for wired network connectivity and power supply
External Antennas	2x LoRa, 1x LTE – ensures optimal coverage and reception
Enclosure	Outdoor-grade aluminum housing, coated

The gateway allows system integrators to choose between operation modes **LoRa packet forwarder** and **basic station**. Configuration can be done through the web interface (LuCI) or command-line (SSH/UCI).

2.4 Operating Principles

1. LoRa-enabled sensors transmit data wirelessly to the gateway.
2. The gateway receives LoRaWAN packets using one or both of its concentrators.
3. Data is forwarded to the configured **LoRa Network Server (LNS)** via LTE or LAN.
4. Downlink messages (e.g., device commands or acknowledgments) are delivered back to the field devices via the same path.

Note: The flexibility of the OpenWrt-based OS allows for significant customization, but misconfigurations may require full recovery via shell access.

3. Safety & Compliance

The ZENNER B.One Gateway outdoor 16 is designed for outdoor industrial environments and complies with standard safety and operational guidelines. This section outlines essential precautions and compliance recommendations for safe handling, installation, and maintenance.

3.1 Handling & ESD Precautions

To prevent damage to the gateway's electronic components, users must observe proper electrostatic discharge (ESD) procedures when opening the device or handling internal components.

Always follow these precautions:

- Wear an anti-static wrist strap connected to a proper ground.
- Avoid touching circuit boards or internal connectors with bare hands.
- Open the device only when necessary (e.g., SIM insertion, LED inspection).
- Ensure the device is powered off before removing the cover or any modules.

Note: ESD-related damage is not covered under warranty.

3.2 Power Supply Safety

The gateway is powered via Power over Ethernet (PoE).

Ensure proper PoE injector use and voltage compliance.

Do not apply power until all Ethernet and antenna cables are securely connected.

Only certified personnel should handle high-voltage components or the PoE source.

3.3 Environmental Conditions

The gateway is intended for outdoor installation and must be used within the specified environmental conditions:

Parameter	**Specification**
Operating Temp.	–10 °C to +60 °C
Storage temperature	-40 °C to +80 °C
Humidity	5% - 95%
TX power	max. 27 dBm(500mW) conducted
Frequency	EU-868
Enclosure Rating	IP67 (fully assembled)
Mounting	Wall or pole mount

3.4 Antenna Handling

Attach all antennas before powering the device.
Ensure that antenna connectors are clean and tightened, and that they are placed according to installation guidelines to avoid interference or physical damage.

3.5 Legal & Regulatory Compliance

We, the company ZENNER International GmbH & Co. KG declare on our sole responsibility, that the product **B.One Gateway outdoor 16** is in conformity with directives of the European Parliament and of the Council, as far as these are applicable to the product:

- 2014/53/EU, 2011/65/EU, 2014/35/EU

Applied standards:

- EN 301 489-1 V2.1.1, EN 301 489-3 V2.1.1, EN 300 220-1 V3.1.1, EN 300 220-2 V3.1.1, EN 62368-1:2014, EN 62311

If used outside of the European Union, it is the responsibility of the system integrator or deploying party to verify local regulatory compliance for:

- LoRaWAN radio frequencies and power levels
- Cellular modem operation and SIM usage
- Certificates or declarations of conformity can be requested from ZENNER if needed.

The Declaration of Conformity is available as a separate document on the ZENNER website: zenner.com.

3.6 Warranty Disclaimer

The device warranty is void if disassembled improperly or damaged due to static discharge, misuse, or improper power supply.
Software modifications or firmware flashing outside of official channels may void support or warranty services.

4. Hardware Setup

This section provides step-by-step instructions for the physical installation of the B.One Gateway outdoor 16, including SIM card insertion, network cabling, power connection, and interpretation of LED indicators.
Note: Before proceeding, ensure that all safety and ESD guidelines from Section 3 have been reviewed and applied.

4.1 Unboxing and Preparation

The gateway is delivered in a partially assembled state. Depending on the assembly situation to be implemented, various preparations and assembly steps are necessary. Furthermore, it may be necessary to acquire additional assembly materials that are not included in the scope of delivery.

- Gateway - pre-mounted on mounting bracket
- Mounting bracket with nuts, spring ring and washers
- 2x spacer sleeves for mounting bracket
- 2x 868 MHz LoRaWAN®-Antennas
- 1x LTE broadband antenna
- 3x Antenna cable
- Cable ties
- 2x RJ45 connector
- Equipotential bonding cable (16 mm²)
- Weatherproof network cable (5 m) with PG cable gland
- Waterproof LAN connector
- PoE injector (not waterproof)
- Power cord for PoE injector (not waterproof)
- 2x safety plugs

Verify that all items are included and undamaged before installation.

4.2 Inserting the SIM Card

To enable cellular (LTE) backhaul, a mini SIM card must be inserted.

Procedure:

1. Power off the gateway by disconnecting any Ethernet/PoE cable.
2. Unscrew and remove the 6 housing cover screws using a Torx or Phillips tool.
3. Locate the LoRa modem inside the unit. Carefully remove its 2 mounting screws and disconnect it if necessary.
4. Identify the SIM slot (mini SIM size). Slide the cover open in the direction marked by the arrow.
5. Insert the SIM card with metal contacts facing down.
6. Close and lock the SIM slot cover by sliding it back to the LOCK position.
7. Reinstall the LoRa modem and secure it with the original screws.
8. Close the housing and tighten the 6 external screws.

Ensure no cables or components are pinched during reassembly. The housing must be sealed to retain IP protection.

4.3 RJ45 Connection and PoE Power Supply

The gateway is powered via **Power over Ethernet (PoE)** and supports data and power over a single cable.

To connect the gateway to the network:

1. Plug one end of a patch cable into the **PoE port** on the PoE injector.
2. Connect the other end to the gateway's **RJ45 Ethernet port**.
3. Use another patch cable to connect the **DATA port** of the injector to your **network router or switch**.
4. Plug the **PoE injector into a 230V power outlet**.

The device will begin booting automatically. Boot time may take up to 30 seconds.

4.4 Mounting and Positioning

For optimal performance:

- Mount the device vertically on a **pole or wall** using the supplied bracket.
- Ensure antennas are vertically aligned and **not obstructed** by metal surfaces.

Proper antenna placement significantly impacts wireless performance. Avoid indoor or shielded installations unless specifically required.

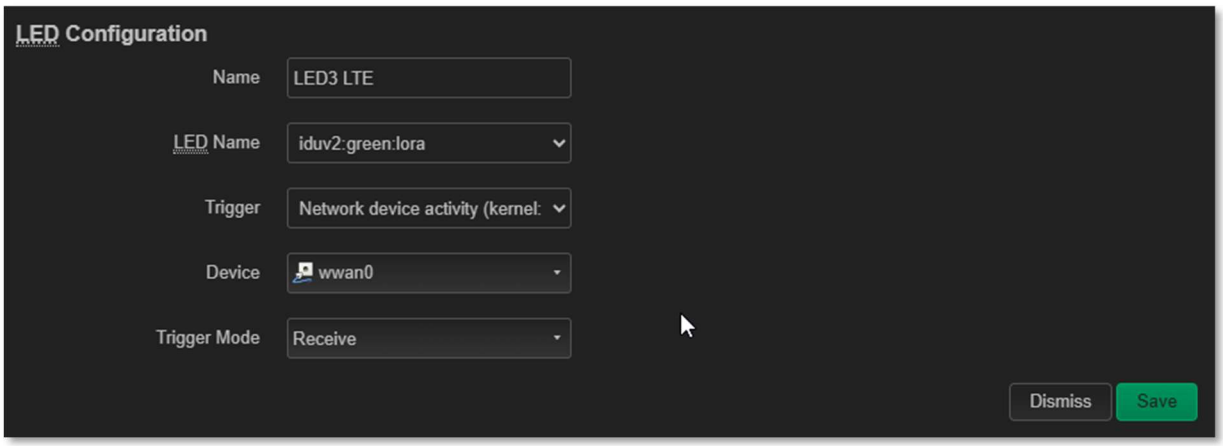
You can find detailed information about mounting in the Installation and operating instructions on zenner.de.

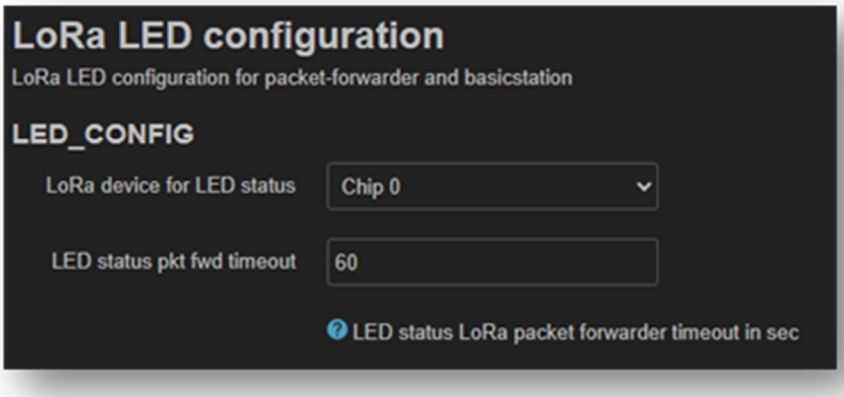
4.5 LED Indicators

The LEDs inside the housing provide operational status. To view them, the housing cover must be removed.

LED	Label	Description
1	Power	Turns **green** after successful boot
2	ETH	Flickers **red** when data is transmitted/received via RJ45
3	LTE	Custom-configurable; Common use case is mobile network status. LED color **red**
4	LoRa	Can be configured to **red** or **green** when the server returns a “message acknowledgment

Note: LED 3 and 4 behavior can be customized via OpenWrt UI.





Here, it can be selected which LoRa modem is to be monitored, and a timeout value (specifying when the status of the LED changes in case of missing acknowledgement)

5. Getting Started

This section explains how to access the B.One Gateway outdoor 16 after physical installation, including obtaining the IP address, logging into the web interface, and establishing a secure connection via SSH.

5.1 First-Time Access via Web Interface (LuCI)

Once the gateway has booted, it can be accessed through its web-based user interface (LuCI), which provides full access to all essential system and network configurations.

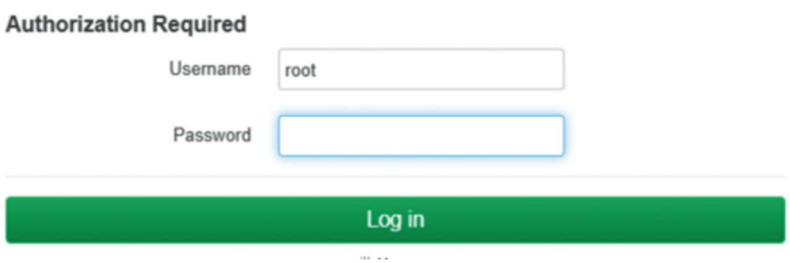
Default Access Information

Parameter	Value
Protocol	HTTP
Default IP	Assigned via DHCP (see section 5.2)
Username	root
Password	Available in your delivery note on the ZENNER Portal: https://portal.zenner.com

Procedure

1. Ensure your PC is connected to the same network (LAN) as the gateway.
2. Open a web browser and enter the IP address of the gateway in the address bar (e.g., http://192.168.1.42).
3. Enter the **username** and **password**.
4. After login, navigate to System → Administration and **change the root password immediately** for security reasons.

The LuCI interface is accessible via HTTP by default. HTTPS access can be enabled in the system settings if needed.



5.2 Determining the Gateway IP Address

The gateway receives its IP address dynamically from your DHCP-enabled router or server upon boot.

Methods to determine the IP:

- Check your DHCP server or router interface to find a new device listed as OpenWrt or similar.
- Use an **IP scanner tool** like Advanced IP Scanner or nmap from a connected device.

5.3 Accessing the Gateway via SSH

For advanced configuration or scripting, the gateway can be accessed via SSH.

Default SSH Settings:

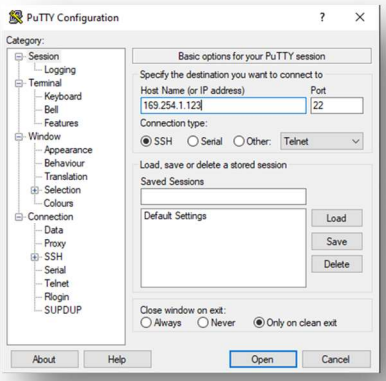
Parameter	Value
Protocol	SSH
Port	22 (customizable)
Username	root
Password	Same as LuCI login

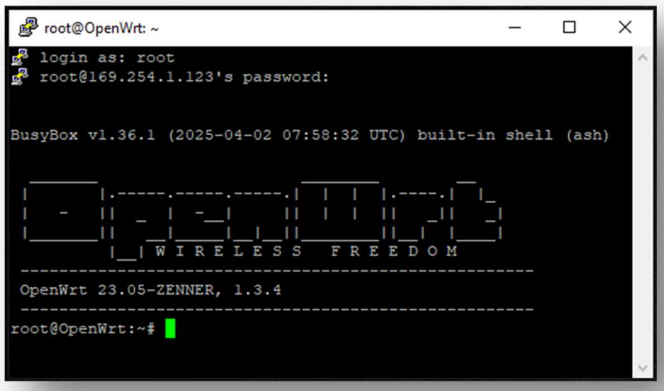
Using SSH Clients:

- **PuTTY (Windows)**:
    1. Launch PuTTY.
    2. Enter the IP address in the **Host Name (or IP address)** field.
    3. Set port to 22.
    4. Click **Open**, accept the security warning if prompted.
    5. Login using your credentials.
- **Windows PowerShell or Linux/macOS Terminal**:

    ssh root@<gateway-ip>

Once SSH access is established, advanced users can configure the system via UCI, monitor logs, install packages, or reset services.





5.4 Important First-Time Actions

After your first login, it is strongly recommended to:

- Change the **root password**
- Update the **system time and timezone**
- Create a **configuration backup** using System → Backup / Flash Firmware
- Enable HTTPS access (optional)

6. Dashboard Overview

After a successful login to the web interface (LuCI), the dashboard provides an at-a-glance summary of the system and network status. It is the central access point for monitoring and managing the B.One Gateway outdoor 16.

For integrators, the dashboard offers:

- Fast verification of system health (uptime, load, memory)
- Confirmation of network uplink status (IP addresses, LTE/WAN connectivity)
- Interface to access LoRa gateway configuration
- Log access for debugging and diagnostics

The LuCI dashboard is not just a display but an active control center for maintaining gateway performance and connectivity.

This section explains the structure and key components of the OpenWrt LuCI dashboard as used in the gateway's firmware (based on OpenWrt 23.05).

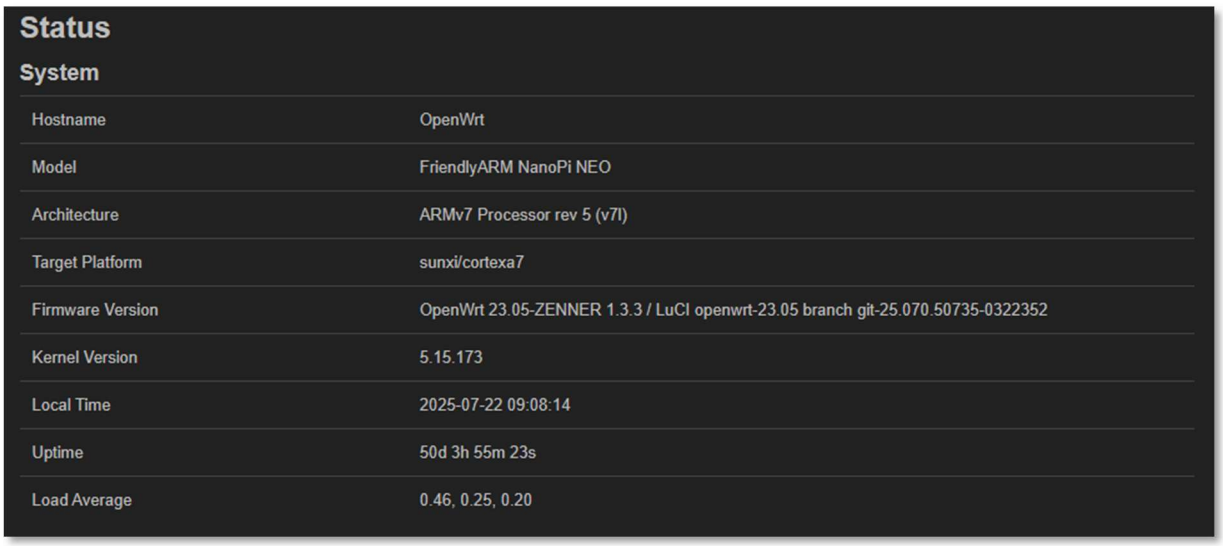
6.1 Dashboard Layout and Navigation

Upon login, you will land on the **Status** → **Overview** page. This dashboard is divided into several sections:

System Information

Displays basic runtime and device data like:

- Hostname and uptime
- Model and architecture (e.g., ARM Cortex-A7)
- Firmware version and OpenWrt release
- Kernel version (e.g., Linux 5.15.x)
- Local time and system load
- Memory usage (total/free)

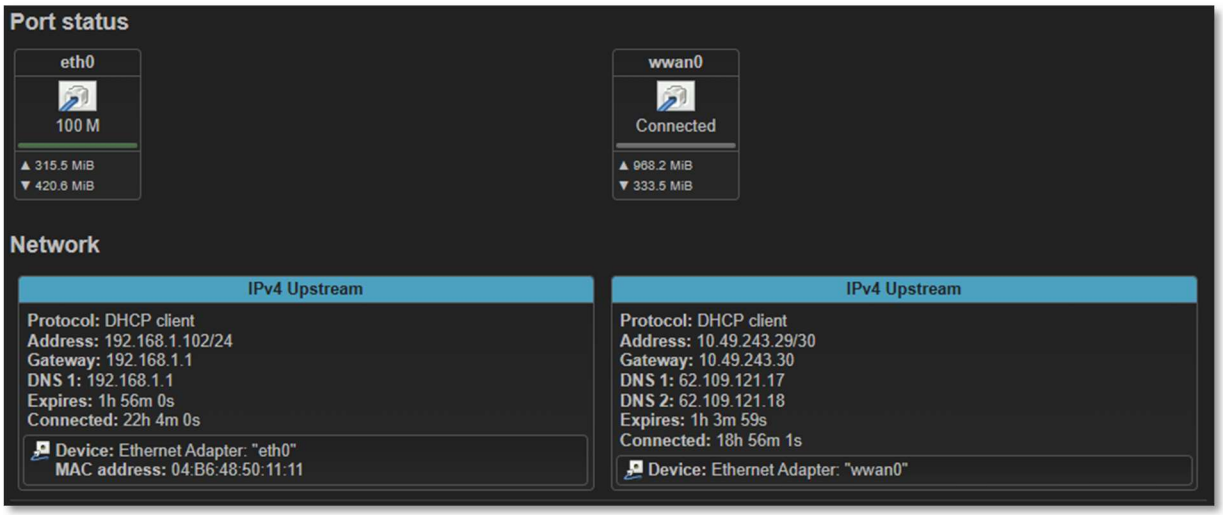


Network Interfaces

Shows the current status of active interfaces:

- **LAN** (usually br-lan): Internal network interface
- **WAN / LTE** (e.g., wwan0, lte0): Outbound uplinks
- IP address (IPv4/IPv6), MAC address

- Received/sent packets (RX/TX)
- Uptime and protocol (e.g., DHCP client)



6.2 Quick Access Navigation

The top menu bar provide categorized access to all system features:

Menu	Key Subsections
Status	Overview, Logs, Processes, Realtime Graphs, etc.
System	Administration, Software, Startup, Backup, Scheduled Tasks, LED Configuration
Network	Interfaces, Routing, Diagnostics, Firewall, LoRa Packet Forwarder / LoRa Basic Station
Logout	Ends current session securely

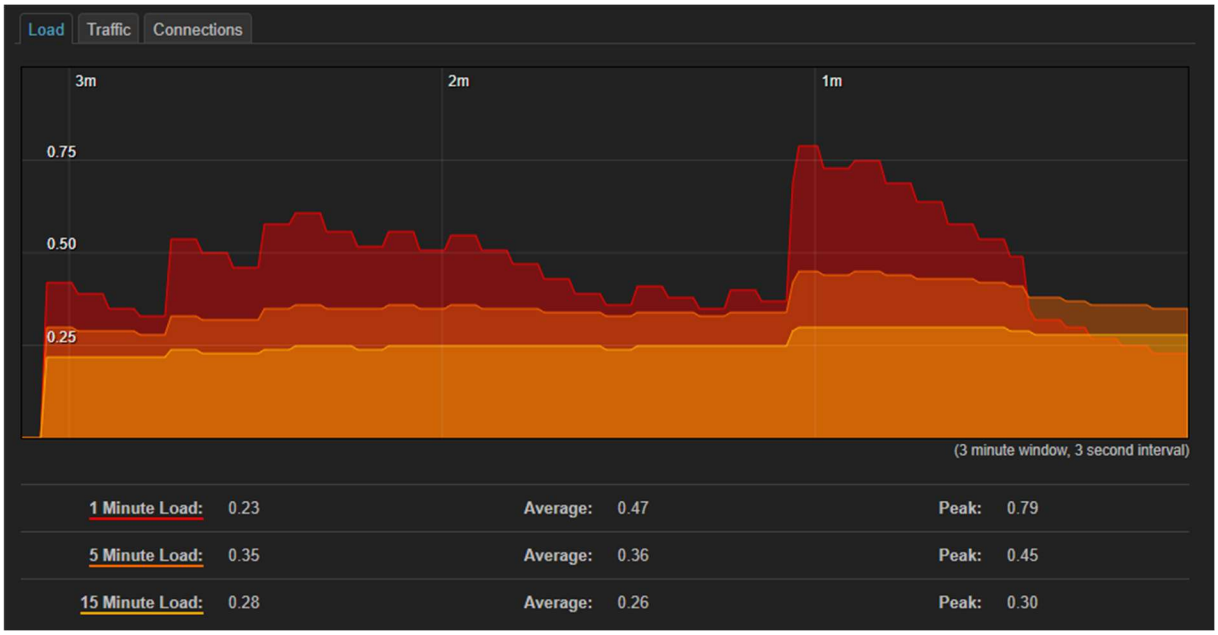
6.3 Realtime Graphs

Located under **Status** → **Realtime Graphs**, these tools allow live monitoring of:

- CPU usage
- Memory usage
- Network traffic by interface
- Active network connections

These graphs help detect traffic spikes, interface activity, or CPU overloads in real time.

For enhanced statistical monitoring, packages like **luci-app-statistics** (with collectd) can be installed.



7. Network Configuration

The network configuration of the B.One Gateway outdoor 16 defines how the device connects to local infrastructure and the internet, enabling it to transmit LoRaWAN data to backend servers. This section covers the configuration of Ethernet, LTE (cellular), and advanced routing options using both the LuCI web interface and command-line tools.

7.1 Accessing Network Settings

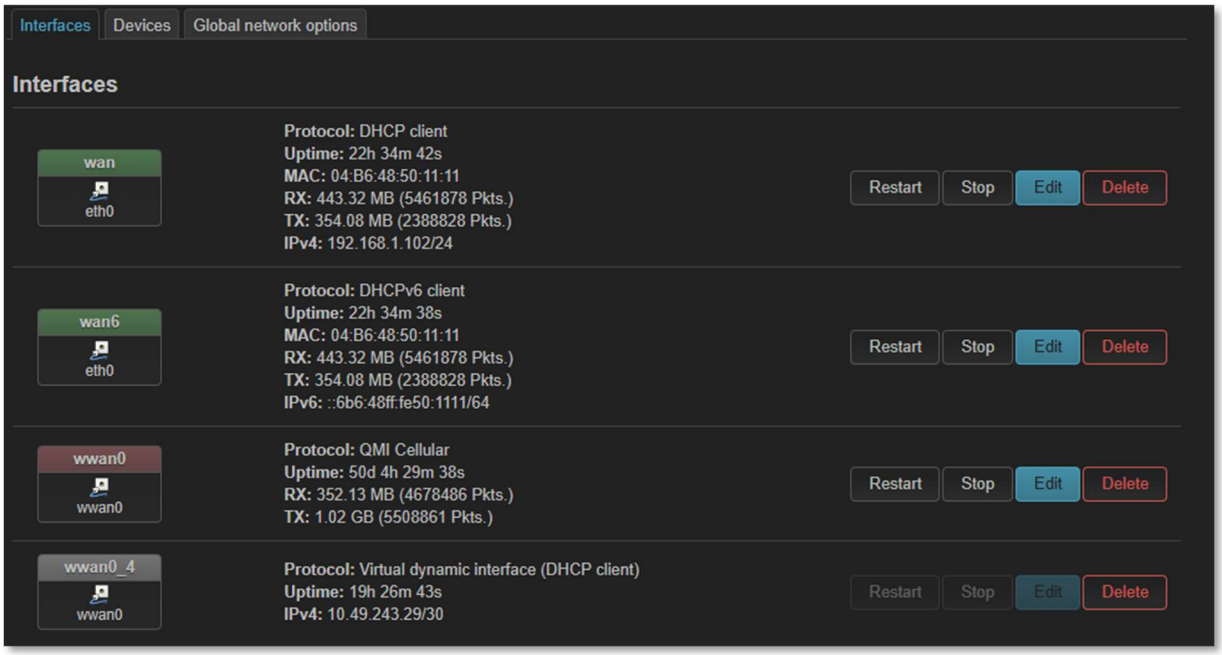
Network settings are available via:

Menu Path:

Network → Interfaces

Each defined interface (LAN, WAN, LTE) is listed here, along with:

- Interface name (e.g., br-lan, lte0, wwan)
- Protocol (DHCP, Static IP, PPP, etc.)
- Assigned IP address (IPv4/IPv6)
- Packet statistics (RX/TX)
- Uptime and status indicators
- Buttons to **Edit**, **Stop**, **Delete**, or **Restart**



7.2 LAN Configuration

The **LAN interface** is typically used for local configuration and routing within a closed network.

To configure LAN with a static IP:

1. Go to **Network → Interfaces**
2. Click **Edit** next to LAN
3. Set **Protocol** to Static address
4. Define the following:
    - IPv4 address (e.g., 192.168.1.100)
    - Netmask (e.g., 255.255.255.0)
    - Gateway (e.g., 192.168.1.1)
    - Custom DNS servers (optional)
5. Save and apply the configuration

7.3 WAN / LTE Interface

The WAN interface may be configured over Ethernet or LTE (SIM-based cellular).

LTE Interface Configuration:

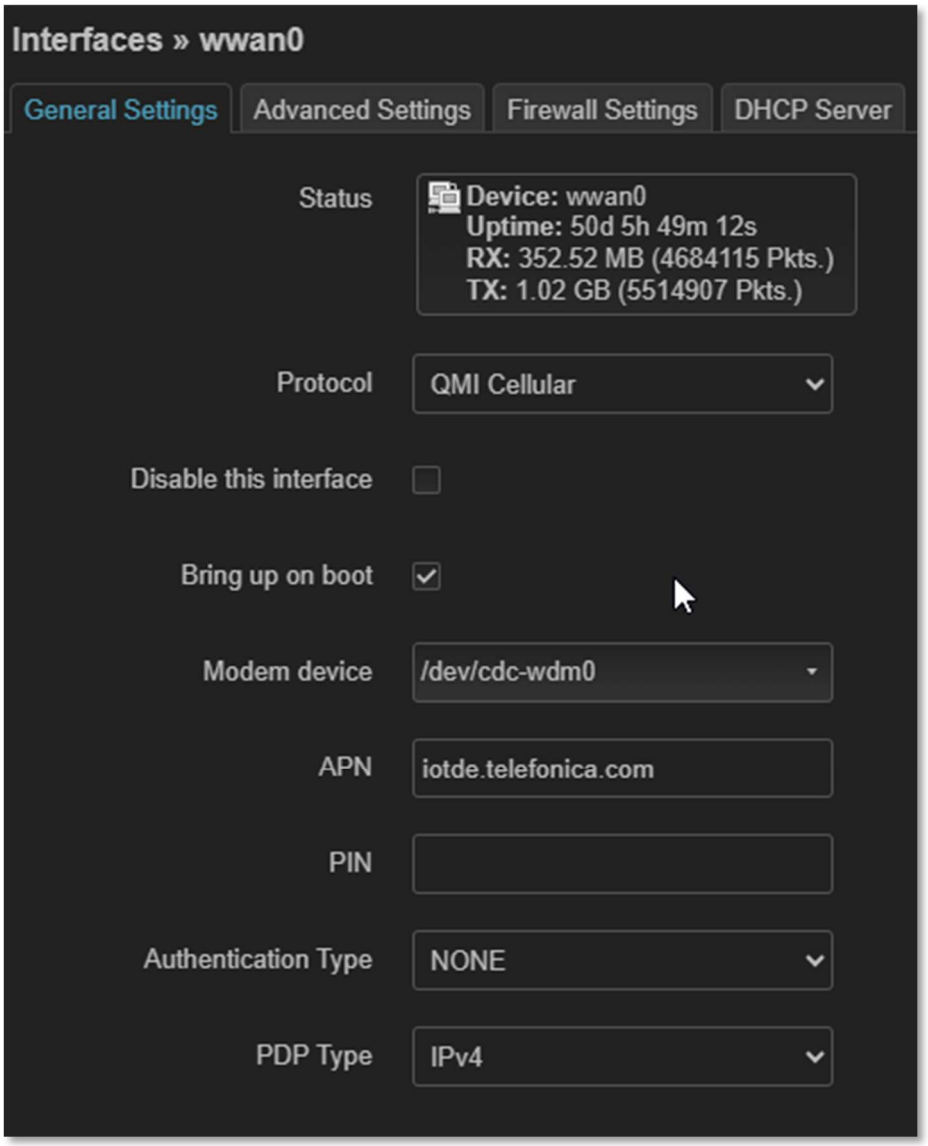
- appears as wwan0

1. Go to **Network → Interfaces**
2. Identify the LTE interface
3. Ensure that the **Protocol** is set correctly:
    - Use QMI Cellular protocol
4. Set APN settings

The LTE APN is configured in the file /etc/config/network. This ensures proper modem initialization at boot.
In the config interface “wwan” section, add the options for ANP and PIN (if necessary)

- option apn “yourAPN”
- option pincode “xxxx”

Or it can be configured via :
uci set network.wwan.apn='YourAPN'
uci set network.wwan.pincode=‘PINCODE‘
uci commit network



7.4 Interface Prioritization (Routing Metrics)

To define which uplink (LAN or LTE) takes priority:

1. In **Network** → **Interfaces**, click **Edit** on the relevant interface
2. Go to the **Advanced Settings** tab
3. Set the **Use gateway metric** field:
    - Lower number = higher priority
    - Example: LAN = 10, LTE = 20 → LAN is preferred

7.5 Diagnostic Tools

OpenWrt provides built-in tools for connectivity tests:

Menu Path: Network → Diagnostics

Available tools:

- **Ping** (test IP or hostname reachability)
- **Traceroute** (network path analysis)
- **NSLookup** (DNS query check)

These tools are essential for debugging LTE/ethernet backhaul or verifying remote server accessibility.

7.6 Best Practices

- Avoid overlapping IP ranges when using dual uplinks (LAN and LTE)
- Always create a config backup before modifying UCI settings
- For high availability, test LTE fallback by physically disconnecting LAN

8. Firewall & Security

The firewall is a core component of the B.One Gateway outdoor 16 and ensures that only authorized traffic can enter or leave the device. Built on **OpenWrt's netfilter/iptables** system, the firewall allows advanced control over interface zones, port access, traffic forwarding, and service exposure.

This section describes how to configure the firewall using the **LuCI web interface** and via **UCI commands**.

8.1 Firewall Zones

Firewall zones define how traffic is handled between different interfaces and the device itself.

Menu Path: Network → Firewall → General Settings

Example of Zones:

Zone	Interface(s)	Input	Output	Forward	MASQ
lan	wan	Accept	Accept	Accept	No
wan	wwan0	Accept	Accept	Reject	Yes

Zone Policies:

- **Input**: From this zone to the router

- **Output**: From the router to this zone
- **Forward**: Forwarded through the router between zones

MASQ (Masquerading) should be enabled for interfaces that route to the internet (typically WAN/LTE).

8.2 Access Control (LuCI & SSH Security)

Menu Path: System → Administration

SSH Security (Dropbear)

- Default port: 22 (can be changed)
- Enable/disable password login
- Allow only SSH key-based access

Best practices:

- Change the default port (e.g., to 2222)
- Disable password login:

9. System Administration

This section describes how to manage the core administrative features of the ZENNER B.One Gateway outdoor 16, including user authentication, time settings, logging, scheduled tasks, and system backups. These tools are essential for secure operation, maintenance, and troubleshooting.

9.1 Changing the Root Password

Note: Upon first login (via LuCI or SSH), you should immediately change the default root password.

Menu Path:

System → Administration → Router Password

Steps:

1. Enter a new secure password.
2. Confirm the password.
3. Click **Save & Apply**.

The root password is used for both LuCI and SSH unless SSH keys are configured.

9.2 SSH Access and Configuration

SSH access is enabled by default and managed by the **Dropbear** service.

Menu Path:

System → Administration → SSH Access

Settings to configure:

- **Listen Interface**: Bind SSH to LAN only (recommended).
- **Port**: Change from default port 22 to a non-standard port (e.g., 2222).
- **Password Authentication**: Disable for enhanced security.
- **Root Login**: Allow or disallow depending on policy.

9.3 System Identification and Time Settings

Menu Path:

System → System

Configurable settings:

- **Hostname**: Set a recognizable name (e.g., zenner-gw01).
- **Timezone**: Choose your local time zone for accurate logs and scheduling.
- **NTP Servers**: Ensure synchronization with reliable public time servers.

Correct system time is critical for logging, VPNs, and secure communication.

9.4 Scheduled Tasks (Cron Jobs)

The gateway supports Unix-style **cron jobs** for automating tasks.

Menu Path:

System → Scheduled Tasks

Examples:

- Reboot weekly at 03:00 on Monday:

*0 3 * * 1 reboot*

- Restart a LoRa service every day at midnight:

*0 0 * * * /etc/init.d/lora_pkt_fwd_chip0 restart*

9.5 System Logs

Logs are essential for monitoring device activity and diagnosing issues.

Menu Paths:

- Status → System Log
- Status → System Log → Kernel Log

Types of logs:

- **System Log**: Events from services and applications.
- **Kernel Log**: Hardware and low-level system messages.

Logs are stored in RAM by default and will be reset after reboot. Persistent logging requires manual setup or external storage.

9.6 Backup and Restore

Menu Path:
System → Backup / Flash Firmware
Backup Options:

- **Generate Archive**: Downloads current configuration as a .tar.gz file.
- **Upload Archive**: Uploads and applies a saved configuration.

Always create a backup before upgrading firmware or making significant changes.

9.7 System Upgrade (Quick View)

Firmware upgrades are covered in Section 12, but access begins here.

- Use **Flash new firmware image** to upload a new image.
- Always **select "Keep settings"** unless a factory reset is intended.

10. Software & Package Management

The B.One Gateway outdoor 16 runs on OpenWrt, which includes a flexible software management system based on the opkg package manager. This allows you to install, update, or remove software packages to extend the functionality of the device.
This section explains how to manage packages using the **LuCI web interface**.

10.1 Accessing the Package Manager (LuCI)

Menu Path:
System → Software
This section provides a web-based frontend for opkg, allowing easy installation and removal of packages without needing to use the command line.

10.2 Updating the Package List

Before installing any new software, you must **refresh the package list** to fetch the latest information from the OpenWrt repository.

Steps:

1. Go to System → Software.
2. Click **Update lists**.
3. Wait until the list refresh completes (may take 10–30 seconds).
4. Search and install packages as needed.

10.3 Installing Packages

To install new features:

1. Use the **Filter** field to search for a package.
    - Example: luci-app-statistics
2. Click **Install** next to the package name.
3. Confirm and wait for the installation to complete.

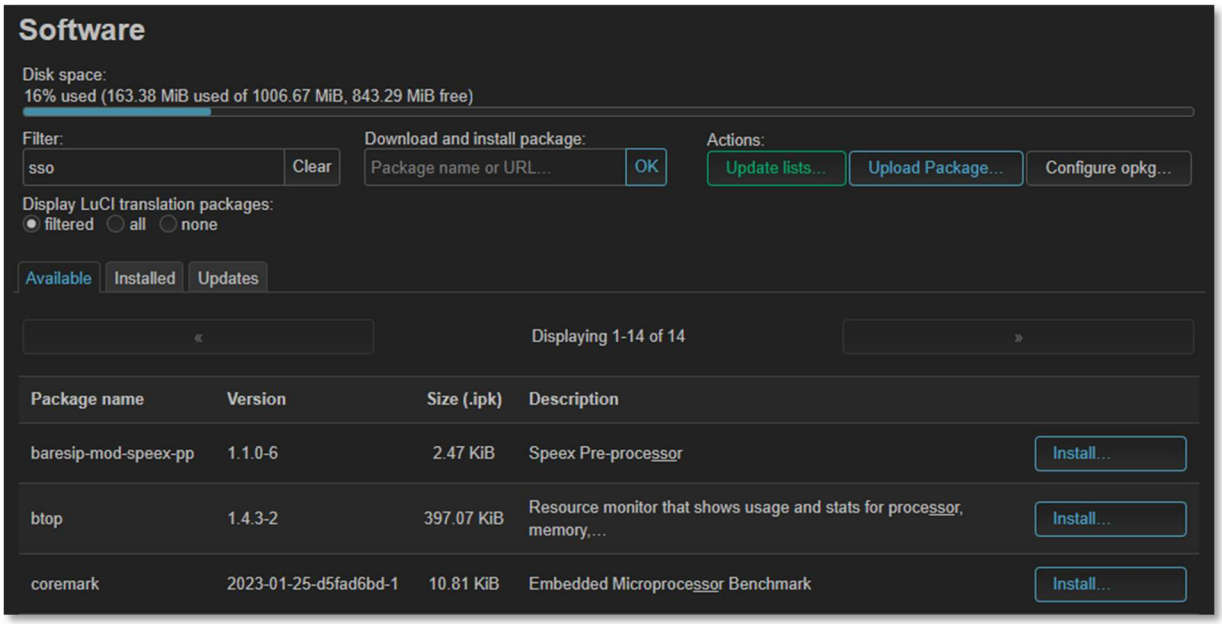
Packages are stored in the device's flash memory. Avoid overloading with unnecessary packages to conserve space.

10.4 Removing Packages

To remove a package:

1. Locate it under the **Installed Packages** section.
2. Click **Remove** next to the package.
3. Confirm removal.

Removing core packages may render LuCI or networking inoperable. Only remove packages you **fully** understand.



10.5 Storage Considerations

- The device has limited onboard storage (flash memory).
- Avoid installing large packages unless necessary.
- You can use external storage or overlays for extended use (advanced setup).

10.6 Best Practices

- Only install what is needed for your use case.
- Keep a list of manually installed packages for reproducibility.
- Test new packages in a non-production environment before deployment.
- Always **backup** before major changes to system packages.

11. LoRa Configuration

The B.One Gateway outdoor 16 supports two independent LoRaWAN concentrators based on the **Semtech SX1302** chipset. Each LoRa modem can operate in one of two modes:

- **Packet Forwarder** (Legacy UDP protocol)
- **Basic Station** (Modern secured protocol, supports CUPS/LNS)

This section explains how to configure LoRa functionality using the OpenWrt LuCI GUI and the Unified Configuration Interface (UCI) for advanced users.

11.1 Overview of Dual LoRa Modem Architecture

LoRa Modem	Typical Usage	Configuration ID
Modem 0	Packet Forwarder or Station	lora_pkt_fwd_chip0 or station1
Modem 1	Independent second channel	lora_pkt_fwd_chip1 or station2

Both modems can be configured separately and used to target different LoRaWAN servers or frequency plans.

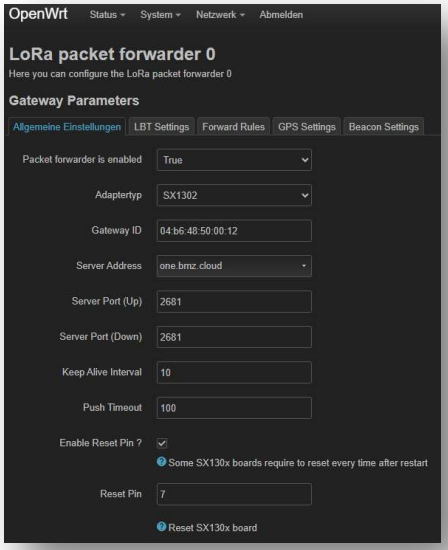
11.2 Configuration via OpenWrt GUI

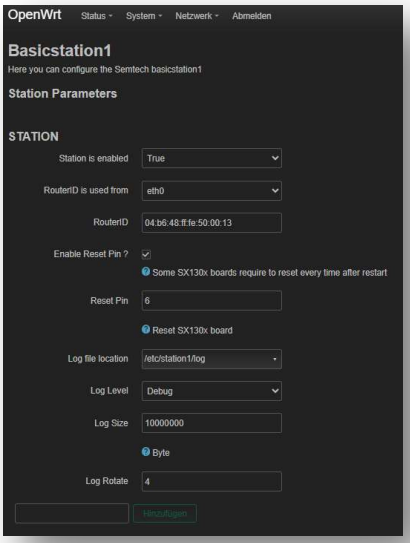
Menu Path: Network → LoRa Packetforwarder / LoRa Basicstation

For each modem (e.g., LoRa Packetforwarder0 or station1), you can configure:

- **Gateway ID** (unique MAC-based identifier)
- **Server Address** (target LNS or cloud server)
- **Up/Down Ports** (UDP)
- **Keep-Alive Interval** (ms)
- **Push Timeout** (ms)
- **Reset Pin** (GPIO)

These values are typically provided by your network server operator or LoRaWAN platform (e.g., The Things Network, Loriot, etc.).





11.3 settings using the LoRa packet forwarder 0 as an example

Gateway Parameters

- Packet forwarder is enabled = True The packet forwarder is active
- Adapter type = SX1302 The LoRa chip which is used, in this case: Semtech SX1302. (The SX1301 is also supported)
- Gateway ID = 00 00 04 b6 48 50 00 00 A unique MAC-based identifier for the gateway
- Server Address = one.bmz.cloud Target server for forwarding LoRaWAN packets (to the LNS).
- Server Port UP = 2681 Port for uploading data from the gateway to the server
- Server Port Down = 2681 Port for downlink messages from the server to the gateway
- Keep Alive Interval = 10 Milliseconds for the signal to maintain the server connection
- Push Timeout = 100 Milliseconds for sending the collected packets
- Enable Reset Pin = 7 GPIO reset pin for SX130X, must be enabled

11.4 settings using the Basic station 1 as an example

Gateway Parameters

- Station is enabled = True Basic station 1 is active
- RouterID is used from = eth0 From which network interface the MAC address is taken as the router ID.
- RouterID = 00 00 04 b6 48 50 00 00 00 Generated automatically from the MAC address
- Enable Reset Pin = 6 GPIO reset pin for SX130X, must be enabled
- Log file location = /etc/station1/log Storage location of the station log file
- Log Level = Debug Specifies how detailed a log file is written

- Log Size = 10000000 Maximum allowed log size in bytes (10MB)
- Log Rotate = 4 Number of log files written

CUPS server

CUPS: Configuration and Update Server. Used to automatically obtain configuration and updates.

- URI = eu1.cloud.thethings.network Address of the CUPS server
- Port = 443 (HTTPS)
- Authentication Mode = TLS Server Authentication and Token Authentication with certificate + token
- Server's CA certificate = < -----BEGIN CERT . . .> PEM certificate of the CA that trusts the TLS certificate of the CUPS server.
- Station's Token = < Authorization: Bearer NNSXS.XXXXXX... > Token for authentication on the CUPS server.

LNS Server

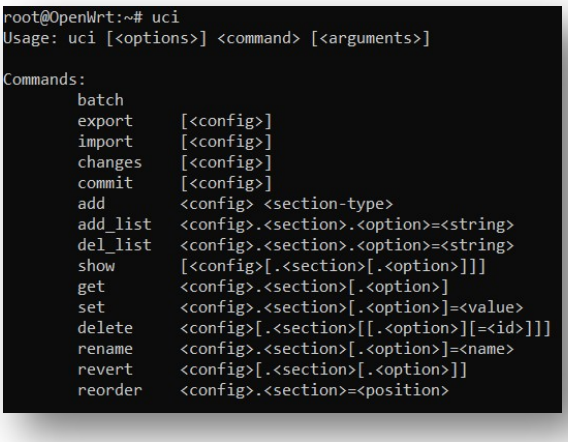
- LNS = LoRa Network Server – e.g. TTN – receives and processes LoRaWAN packets.
- URI = eu1.cloud.thethings.network Address of the LNS server, e.g. eu1.cloud.thethings.network
- Port = 8887 (HTTP)
- Authentication Mode = No Authentication

For a TLS connection to the LNS, a certificate and, if necessary, a token must also be entered here.

11.5 LoRa configuration via UCI (Unified Configuration Interface)

UCI is a program from OpenWRT for configuring the system. Configurations are located in the directory /etc/config

Entering the command “uci” in the shell will display a list of parameters.



Both config files lora-global_chip0 and lora-global_chip1 can be modified here as follow:

uci set lora-global_chip0.gateway_conf.serv_port_up=2681
uci set lora-global_chip0.gateway_conf.serv_port_down=2681
uci set lora-global_chip0.gateway_conf.gateway_ID=000004B648500000

uci set lora-global_chip0.gateway_conf.server_address=one.bmz.cloud
uci set lora-global_chip1.gateway_conf. serv_port_up=2681
uci set lora-global_chip1.gateway_conf.serv_port_down=2681
uci set lora-global_chip1.gateway_conf.gateway_ID 000004B648500001
uci set lora-global_chip1.gateway_conf.server_address=one.bmz.cloud

commit and persistent storage and restart as follows:
uci commit lora-global_chip0
uci commit lora-global_chip1
/etc/init.d/lora_pkt_fwd_chip0 restart
/etc/init.d/lora_pkt_fwd_chip1 restart

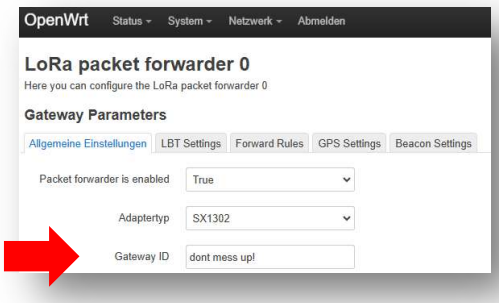
Checking the setting (example):
head -n17 /etc/config/lora-global_chip0

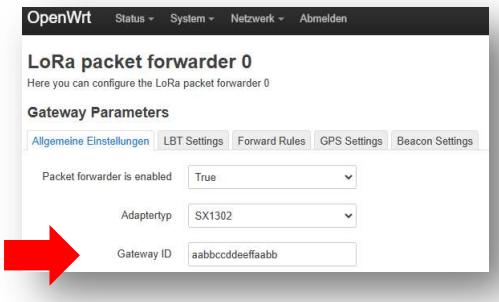
12. Recovery and Maintenance

The B.One Gateway outdoor 16 includes built-in recovery tools for restoring system integrity in case of misconfiguration, package removal, or firmware issues. These tools can be accessed via SSH and are designed to simplify system recovery without the need for reflashing the firmware manually.

12.1 Configuration Recovery

If configuration files are corrupted or incorrectly changed (e.g., wrong Gateway ID, broken interface setup), you can restore the default configuration using the **recover-config.sh** script.
Example: the Gateway ID “don’t mess up” was given by error as Gateway ID
Left side before recovery, right side after recovery.





Establish a connection using SSH client to the gateway and enter the following command.
recover-config.sh

An information panel appears, that indicates that the recover-config process is in progress

and that the power supply must not be cut off until the script has finished.

The gateway restarts automatically and has restored the configuration to its factory settings.

This is helpful if incorrect parameters prevent the device from connecting or communicating with the backend.

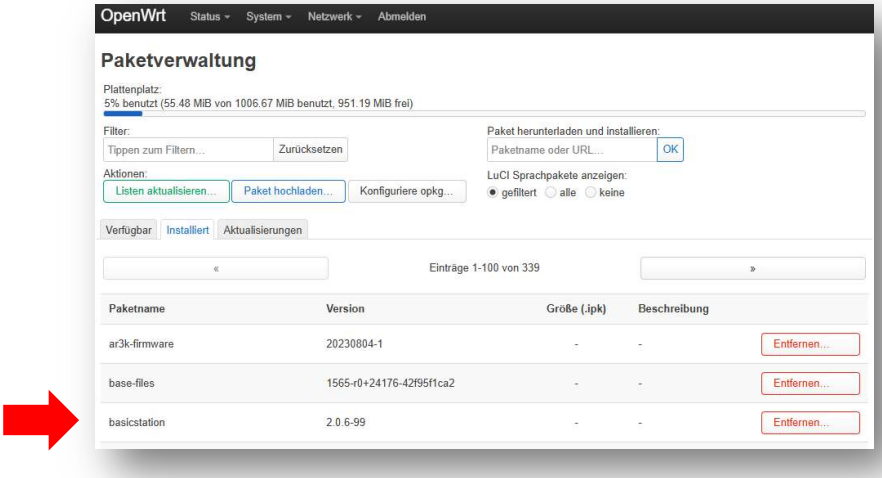
12.2 System Recovery

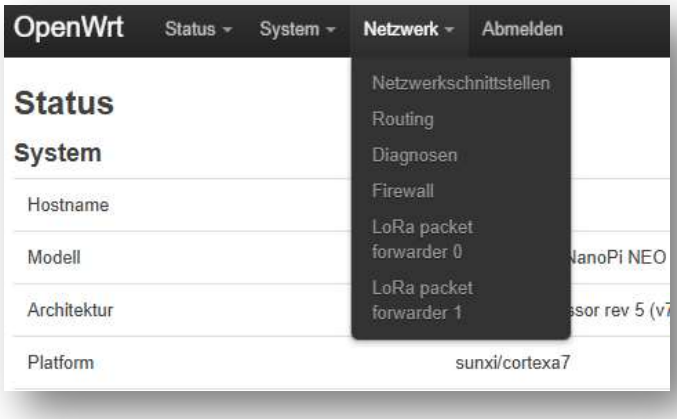
If essential packages (such as LoRa Basic Station) have been deleted, or if the filesystem is damaged, you can restore the system components using the **recover-system.sh** script.

Example Scenario:

You removed the package basicstation by accident. It no longer appears in:

System → Software → Installed Packages





Procedure:

1. Connect to the gateway via SSH.
2. Run the system recovery script:

   recover-system.sh
3. The script will reinstall default packages, configuration templates, and services.
4. The system may take **up to 5 minutes** to complete the restoration.
5. After completion, the gateway will **reboot automatically**.

This tool is designed to make the system operational again without requiring firmware flashing via the web interface or recovery console.

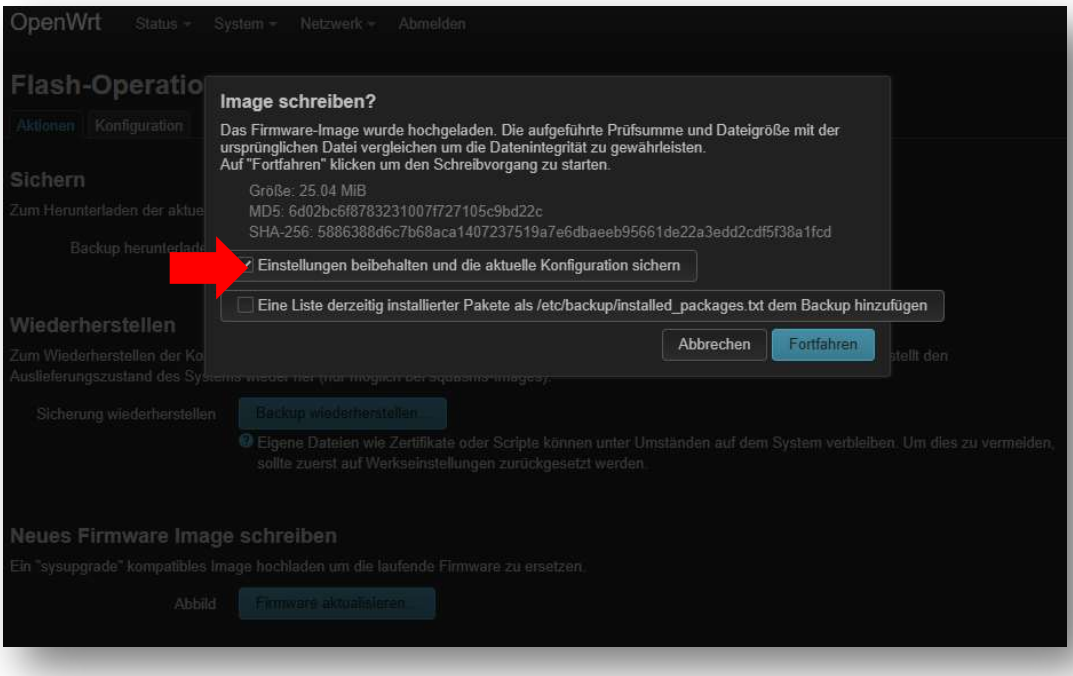
12.3 Firmware Update

You can update the device firmware using the LuCI interface.

Menu Path: System → Backup / Flash Firmware

Steps to Update:

1. Click **“Update firmware…”**
2. Select the .bin firmware image file provided by ZENNER or downloaded from the official source.
3. Confirm when prompted:
    - **Check the box** for “Keep settings and retain current configuration”
    - If you leave this box unchecked, the system will be reset to factory defaults
4. Click **“Continue”** to begin the flashing process.
5. Wait until the update completes — the system will **automatically reboot**.



12.4 Post-Update Checklist

After a successful firmware update:

- Log in via LuCI or SSH
- Check interface status and IP addresses

- Verify LoRa configuration is still present
- Confirm SSH access and keys are still active
- Reapply custom packages if needed

13. Troubleshooting

This section outlines typical problems, diagnostic steps, and built-in recovery features. Whether you're an installer, network engineer, or support technician, this guide helps you resolve issues quickly and effectively.

13.1 Common Issues & Solutions

Problem	Possible Cause	Solution
Cannot access web interface	No IP assigned / Firewall issue	Use IP scanner or reset configuration
SSH connection refused	Wrong port / SSH disabled	Check Dropbear settings or use fallback LAN access
LoRa not sending data	Gateway ID mismatch / wrong server URI	Double-check LoRa config, restart service
Internet not reachable	LTE APN incorrect / DNS missing	Verify modem init script, check routing, test with ping
Firmware update failed	Image incompatible or incomplete	Use ZENNER image only, enable "Keep Settings" during upgrade
System log empty	Logging not enabled or time not synced	Restart log daemon, verify NTP and timezone

13.2 LED Behavior Reference

The gateway is equipped with LED indicators visible after opening the housing.

LED Location	Color	Status Meaning
Power LED	Green	Device powered and operational
Ethernet LED	Green/Amber	Link/activity indicator (depending on switch/router)

LED Location	Color	Status Meaning
LTE Modem LED	red	LTE signal and activity status (Custom-configurable)
LoRa Modem LED	Red/Green	Heartbeat or transmission status(Custom-configurable)

13.3 How to Contact Support

If you're unable to resolve the issue using this manual, ZENNER provides professional support for hardware and software.

Contact Options:

- **Contact your local Distributor or Reseller**

When contacting, please provide:

- Gateway **model and serial number**
- Firmware version (System → Overview)
- Description of the issue
- What you've already tried (commands, steps, logs)
- Log excerpts if available (logread, dmesg)

Note: The more detail you provide, the faster your issue can be diagnosed and resolved.

14. References & External Links

Below is a curated list of official documentation, firmware sources, and helpful online tools relevant to the ZENNER B.One Gateway outdoor 16 and its OpenWrt-based software environment.

ZENNER Resources

- ZENNER delivery note portal (Access default passwords): https://portal.zenner.com
- ZENNER Product Website (Overview, datasheets, and contact): https://zenner.com

OpenWrt Documentation

- OpenWrt User Guide (Full documentation for LuCI, UCI, and system setup): https://openwrt.org/docs/guide-user/start
- LuCI Essentials (Web UI Overview) https://openwrt.org/docs/guide-user/luci/luci.essentials

- UCI System Reference
  https://openwrt.org/docs/guide-user/base-system/uci
- opkg Package Manager
  https://openwrt.org/docs/guide-user/additional-software/opkg
- OpenWrt Releases (v23.05.x)
  https://openwrt.org/releases/23.05/start

LoRaWAN Integration

- Semtech Packet Forwarder
  https://github.com/Lora-net/packet_forwarder
- Semtech Basic Station
  https://github.com/lorabasics/basicstation

Always verify documentation and download links on their respective official websites. ZENNER provides no guarantees for third-party platforms.