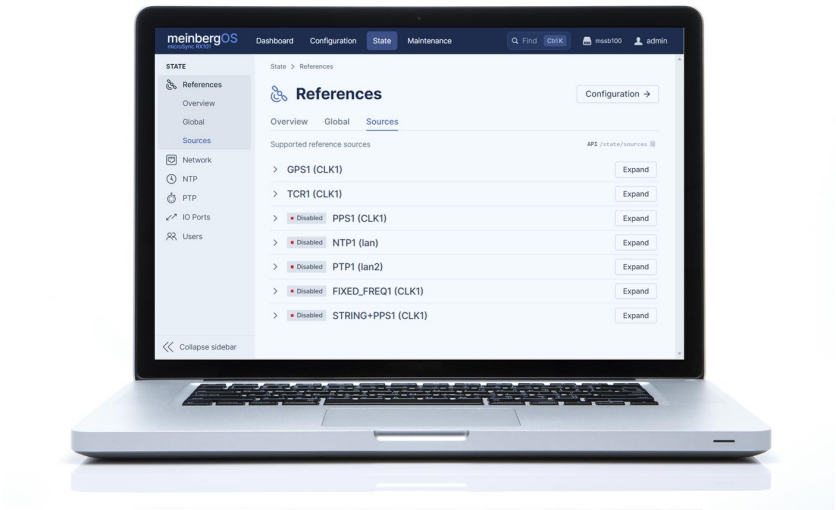
The Synchronization Experts.



MANUAL

meinbergOS Web Interface

Version 2022.05.1

Configuration and Management Manual

September 21, 2022

Meinberg Funkuhren GmbH & Co. KG

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1 Imprint

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3 Introduction: meinbergOS Web Interface

microSync systems with meinbergOS Version *2022.05.1* or later provide a feature-rich Web Interface that can be used to perform most configuration processes easily and also allows you to monitor your device's status and condition.

The meinbergOS Web Interface provides access to your microSync system's most essential configuration functions and also allows you to monitor the status of the system, install new firmware versions, and archive old versions.

For many operations, the Web Interface therefore eliminates the need to install a desktop application or run a portable application from a USB flash drive.

The Web Interface will be updated automatically whenever the meinbergOS device firmware is updated.

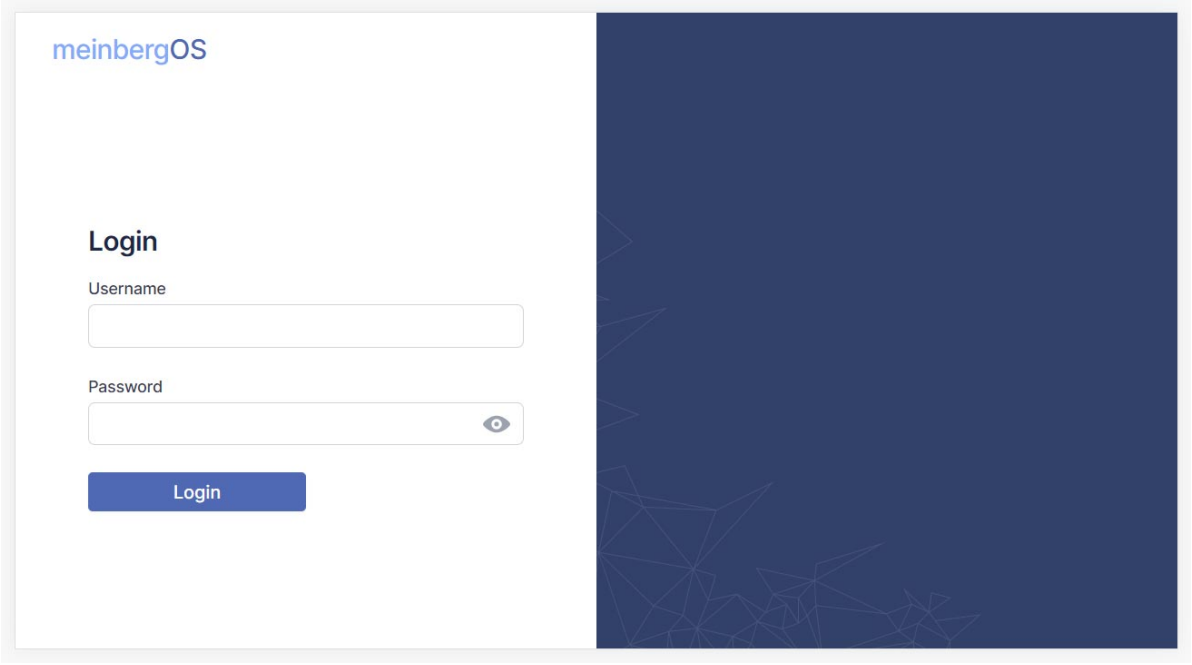

Figure 3.1: Login Page of meinbergOS Web Interface

Once you have entered the IP address of your meinbergOS device into the address bar of your web browser, the login page will appear (Figure 3.1).

The default settings are:

Username: *admin*
Password: *timeserver*

Information:

If your meinbergOS system is not yet configured for your network, please refer to the Technical Reference of your meinbergOS system, specifically the chapter "Initial Network Configuration", for further information on how to configure your meinbergOS system accordingly.

Information:

In the interest of optimizing the security of your meinbergOS device, it is recommended to carefully study not only this manual but also the **meinbergOS Security Guide**, which is available from Meinberg if you do not already have it.

3.1 Terminology of Navigation Elements in the meinbergOS Web Interface

The following terminology is used to describe the display and navigational elements that are employed in the meinbergOS Web Interface:

The **Web Interface** (always capitalized) denotes the entirety of the meinbergOS configuration and monitoring interface accessible via a conventional web browser.

The **Header Bar** (always capitalized) is the navigation bar at the top of the page in the standard meinbergOS page layout. While in *Light Mode*, it is distinguished by its dark blue background.

The **Sidebar** (always capitalized) is the bar located on the left of the page, containing links to the various subsections of each section.

The **User Menu** (always capitalized) is the menu available by selecting the user name at the right of the Header Bar.

Page refers to any complete page layout in the web browser, including Header Bar, Sidebar, and tabs, as well as the contents of the section. It can also refer to any page that does not conform to the standard meinbergOS Web Interface layout (e.g., login page).

The **Content Area** (always capitalized) is the area in which all content is shown outside of the Header Bar and Sidebar. In *Light Mode* it is distinguished by its white background.

Section refers to the four main sections listed in the Header Bar: **Dashboard**, **Configuration**, **State**, **Maintenance**.

Subsection refers to a subdivision of a section, linked to in the Sidebar and marked by icons on the left.

Tab refers to a subdivision of a subsection, which groups information and options under the horizontally organized headers beneath the heading of each subsection in the Content Area. The active tab is underlined. Tabs can also be accessed via the Sidebar, where they are listed (without icons) beneath the open subsection.

Panel refers to any wide rectangular layout element denoted by a title with information or options below it. Panels may also feature **sub-panels**. Panels and sub-panels may feature a right-facing arrow ">" on the left and/or a button marked **Expand** or **Collapse** on the right, if space could reasonably be saved by hiding the content. In this case, a collapsed sub-panel can be expanded by selecting it to reveal more information or options, and an expanded sub-panel can be collapsed by selecting it again to hide this information and options.

Checkbox refers to any navigational element that can be enabled (denoted by a rounded square with a checkmark) or disabled (denoted by an empty rounded square).

Button refers to any element that is solely clicked on (using a mouse or touchpad) or pressed (on a touch display) to perform a given function.

Tile refers to any rectangular or square element that is part of a grid-like layout (such as that on the Dashboard) and provides a brief overview of the information that can be accessed by selecting it.

Dialog box refers to any prompt that appears inside a page that renders the rest of the page inoperable until closed (for example, a file selection dialog box).

An element is described as **grayed out** if a normally black or colored navigation element is deliberately displayed in a light gray against a white background for the purpose of indicating that it is not modifiable.

3.2 Formatting and Structural Principles of this Manual

This manual applies the following formatting and structural conventions in relation to the meinbergOS Web Interface:

Structure

Sections of the meinbergOS Web Interface are described in first-level chapters, specifically **Chapters** 5 (Dashboard), 6 (Configuration), 7 (State), and 8 (**Maintenance**).

Subsections of a given section of the meinbergOS Web Interface are described in second-level chapters beneath that section, for example **Chapter** 6.2, **Configuration - Network**.

Tabs under a subsection of the meinbergOS Web Interface are described in third-level chapters beneath that subsection, for example, **Chapter** 6.2.2, **Configuration - Network - Interfaces**.

Where specific guidance regarding selected processes is warranted, it is provided in a corresponding second, third or fourth-level chapter under the relevant section, subsection, or tab where it is conventionally performed and prefixed with the word "Guide". Example: **Chapter** 8.1.3.1, **Guide: Installing a New Firmware Version**.

Formatting

Names of sections, subsections, and tabs are displayed in **bold text**. The full navigational path to a given tab or subsection is shown in quotation marks, bold, and separated by a right arrow symbol (→). Example: "**Configuration** → **Network** → **Interfaces**".

Field names, and button labels are also displayed in **bold text**. Example: **Install New Firmware**.

Filenames, possible values, and listed options for a configuration or status field are conventionally listed in *italics*. Example: The firmware is provided as an *.ufu* file.

References to other chapters in this manual are shown in dark blue and bold, and if the manual is viewed in a supported PDF reader, can be clicked on to directly jump to that chapter. Example: **Formatting and Structural Principles of this Manual**.

3.3 Basic Configuration Principles

meinbergOS operates on the basis of a dual-configuration system: the **Running Configuration** and the **Startup Configuration**.

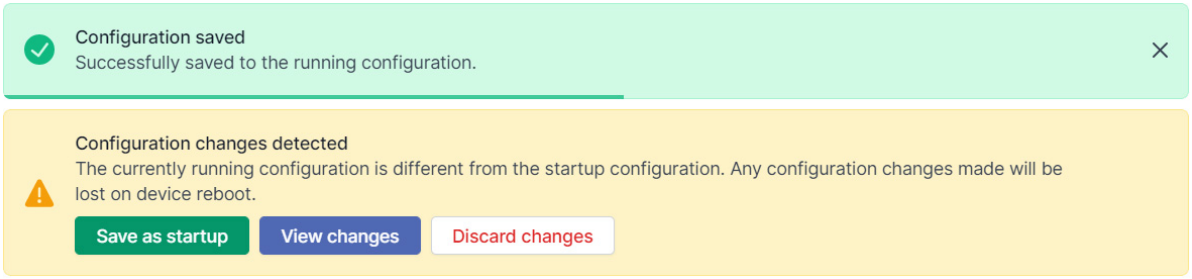

Figure 3.2: meinbergOS Web Interface: Saving Changes to the Running Configuration

The **Running Configuration** is the configuration that is currently active on the meinbergOS device. Whenever a change to the configuration is applied using a **Save** button, that change will be confirmed using the green dialog box shown in the screenshot above, which confirms that it has been applied to the Running Configuration.

The **Startup Configuration** is the configuration that is applied as the Running Configuration when the meinbergOS device is (re)booted. If there are differences between the current Running Configuration and the saved Startup Configuration, the yellow dialog box shown in Fig. 3.2 will be displayed. To save the Running Configuration as the Startup Configuration, click on **Save as Startup** and the Startup Configuration will be overwritten with the current Running Configuration.

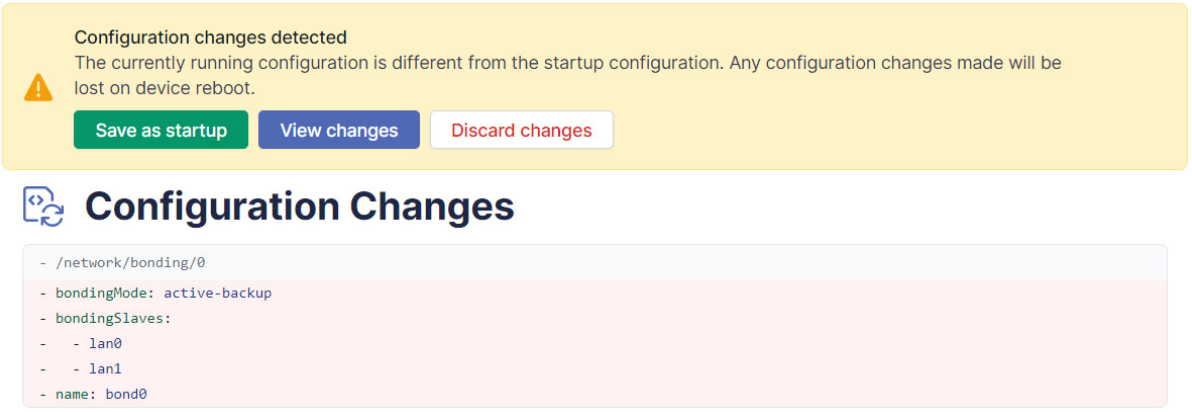

Figure 3.3: meinbergOS Web Interface: Reviewing Changes to the Configuration

If you are unsure which changes have been made to the configuration and wish to review them before adopting them as the Startup Configuration, click on **View Changes** to view the changes that have been made (see Fig. 3.3).

To reject all changes to the configuration and re-apply the Startup Configuration, click on **Discard Changes**.

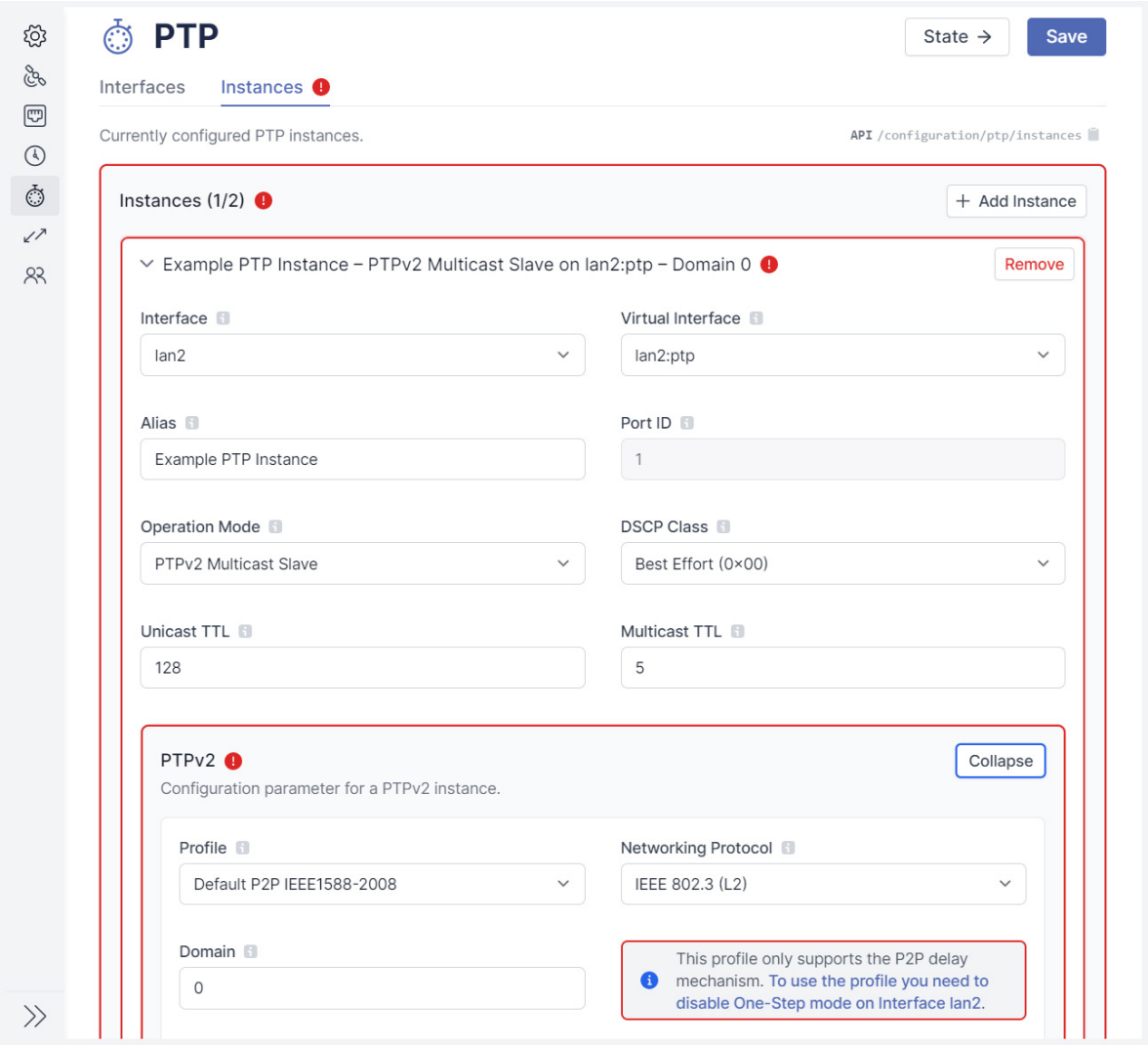

Figure 3.4: meinbergOS Web Interface: Detailed Indication of an Error in Configuration

If a configuration cannot be saved due to an error in an entry or a conflict between two settings, the red dialog box shown in Fig. 3.4 will appear and the source of the conflict or error will be identifiable by a red frame and red alert symbol around the relevant panels and/or fields.

If the source of the conflict or error is located in another subsection, the corresponding tab will show a red alert symbol next to it.

Figure 3.5: meinbergOS Web Interface: Automatic Adjustment of a Parameter

When a parameter is manually adjusted, meinbergOS may automatically adjust another parameter in the same subsection to ensure consistency and avoid configuration conflicts. When this happens, a notification will appear at the bottom of the page with a black background (Fig. 3.5), indicating what exactly has been changed.

4 Header Bar

Figure 4.1: meinbergOS Web Interface: Header Bar

The **Header Bar** (Fig. 4.1) is the primary method of navigation throughout the meinbergOS Web Interface. It can be used to navigate to any of the Web Interface's four main sections, and provides a **Find Anything** tool for locating a certain option in the Web Interface's many sections, subsections, and tabs. It also provides a summary of the configured network interfaces, and a user menu for managing the visual design of the interface and the current user account.

Find Anything

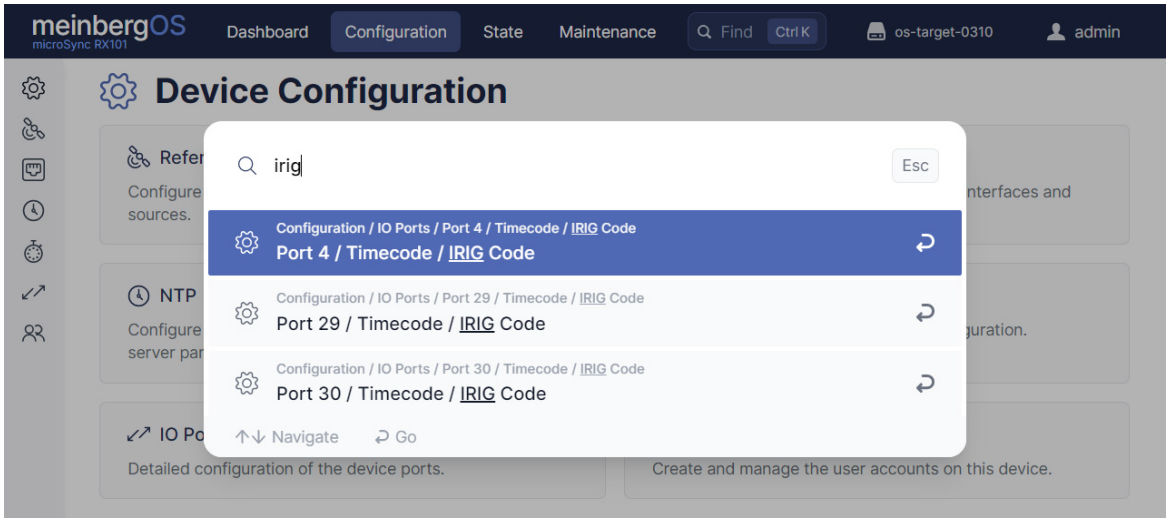

Figure 4.2: meinbergOS Web Interface: Find Anything

The **Find Anything** tool (Fig. 4.2) can be used to quickly find and immediately jump to any option found in any section, subsection, or tab of the Web Interface. As the field suggests, it can also be accessed from a keyboard using the *CTRL+K* shortcut (or *Command+K* if using a browser under MacOS). Enter the search term, then click on the desired entry in the search results dialog box that appears in the middle of the page.

Network Summary

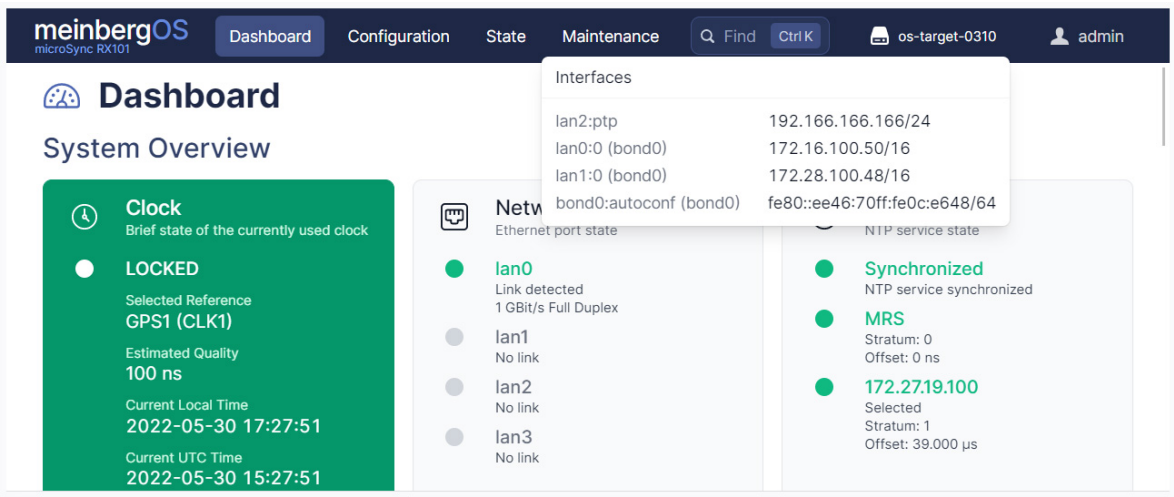

Figure 4.3: meinbergOS Web Interface: Network Summary

The **Network Summary** (Fig. 4.3) displays the current hostname of the meinbergOS device (*os-target-0310* in the example above) and can be selected to display an overview of the currently configured network interfaces.

User Menu

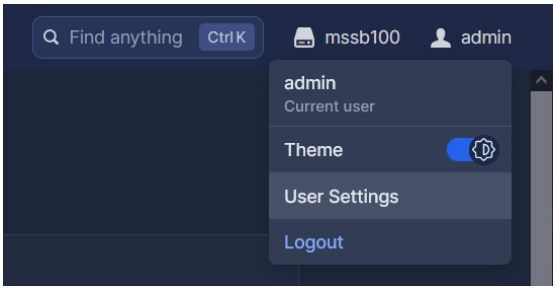

Figure 4.4: meinbergOS Web Interface: User Menu

The **User Menu** (Fig. 4.4) shows the current username. One of its functions is to change the account password (via **User Settings**), which we urgently recommend you do once the system is set up.

The **Theme** switch can be used to change the meinbergOS color scheme between *Light Mode* and *Dark Mode*. *Dark Mode* may be easier on the user's eyes when working in poorly lit environments.

5 Dashboard

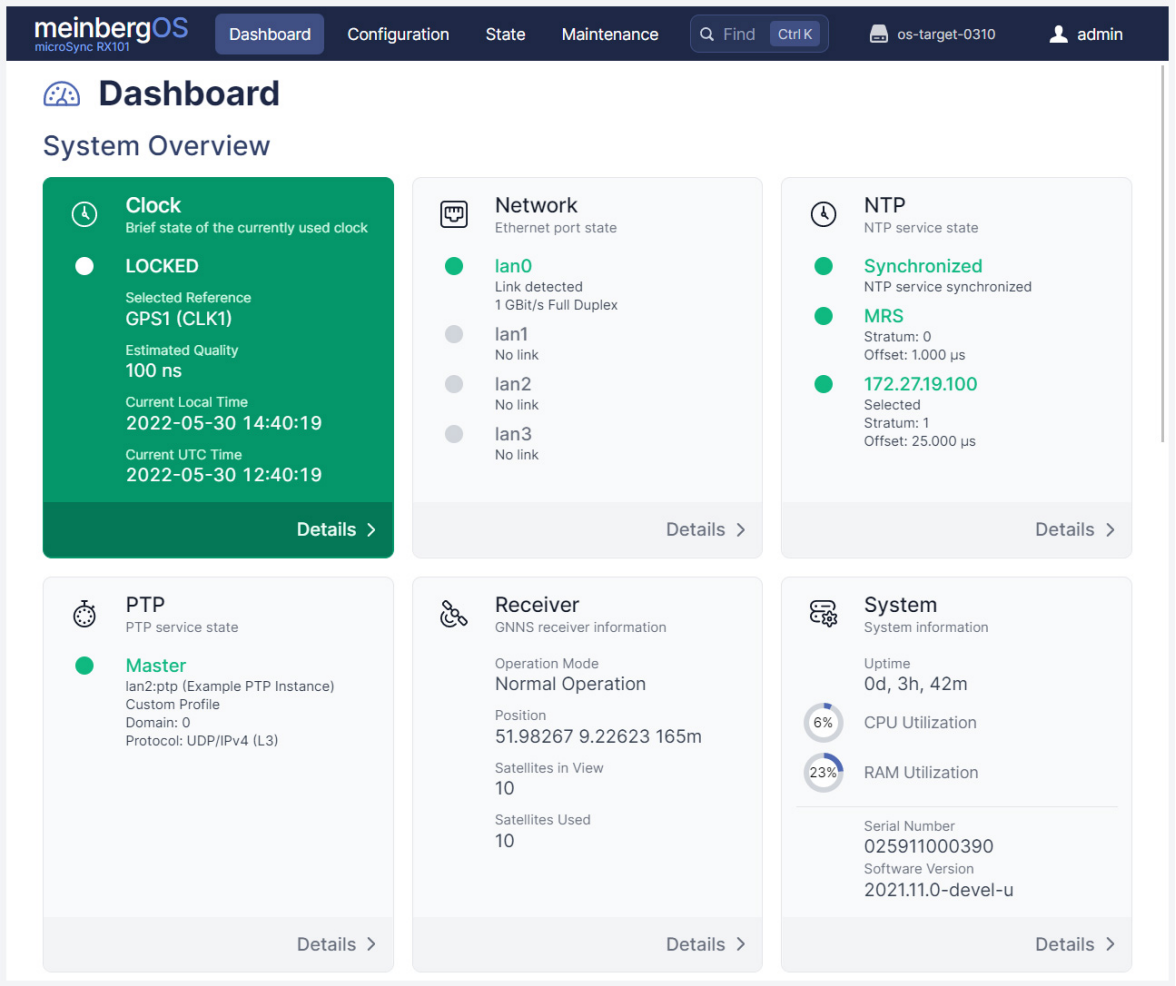

Figure 5.1: meinbergOS Web Interface Dashboard

The **Dashboard** (Figure 5.1) provides an overview of the most important system information, including:

Clock Status: The synchronization status of the receiver currently in use. The color of this tile makes the synchronization status of the meinbergOS device immediately apparent. If it is green, the reference source is locked and synchronized. If it is yellow, the clock is still synchronizing or locking, or is temporarily in Holdover Mode. If it is red, there is a problem with the reference clock that requires attention and the meinbergOS device will operate in free run mode until appropriate action has been taken.

Network: This tile shows a brief overview of the available Ethernet links. A green indicator shows an active and functional link and the link mode is displayed beneath it. Gray denotes the absence of a link.

NTP: This tile briefly indicates the state of the internal NTP service, and if synchronized with external NTP servers, the state of the main NTP server.

PTP: This tile shows the state of the PTP service, indicating the virtual interface, protocol in use, and the current PTP profile.

Receiver: This tile provides information on the meinbergOS device's primary receiver, including its current mode of operation (normal, cold boot, etc.), the current calculated position, the number of satellites in view, and the number of satellites currently in use.

System: This tile provides system information such as the serial number and firmware version.

Below these Dashboard tiles there is also an overview of all active and inactive reference sources, input and output signals, communication interfaces, and configured virtual network interfaces.

6 Configuration

Figure 6.1: meinbergOS Web Interface: "Configuration" Section

The **Configuration** section (Figure 6.1) is where the fundamental system parameters are configured and managed.

References: This is where you can configure the reference sources supported by your system. It also provides options for the prioritization of references, the ability to compensate for propagation delays, and an option to manually define static precision values for each reference.

Network: The network connectivity of your meinbergOS device is configured here. This subsection also provides options for PRP support, network bonding, and configuration of virtual interfaces, as well as the ability to make advanced modifications to your network configuration via the integrated text editor (e.g., for static routing).

NTP: This subsection is used to configure the NTP server functionality of your meinbergOS device as well as external NTP servers. You can also enter symmetric keys here for authenticating NTP packets and enter advanced NTP configuration options using the integrated text editor.

PTP: The PTP subsection contains all options relating to the PTP functionality of your meinbergOS device, in particular the physical interfaces, the operating mode (*Master*/*Slave*), and also PTP multicast and unicast transmission settings.

IO Ports: This subsection provides a visual representation of all physical inputs and outputs to enable you to make suitable port-specific adjustments, to allow you to find the appropriate configuration subsection more easily, and also to obtain information about pin assignments with GPIO connectors.

Users: The **Users** subsection provides options for user and password management, and also allows you to set a user security policy and user permissions.

6.1 Configuration - References

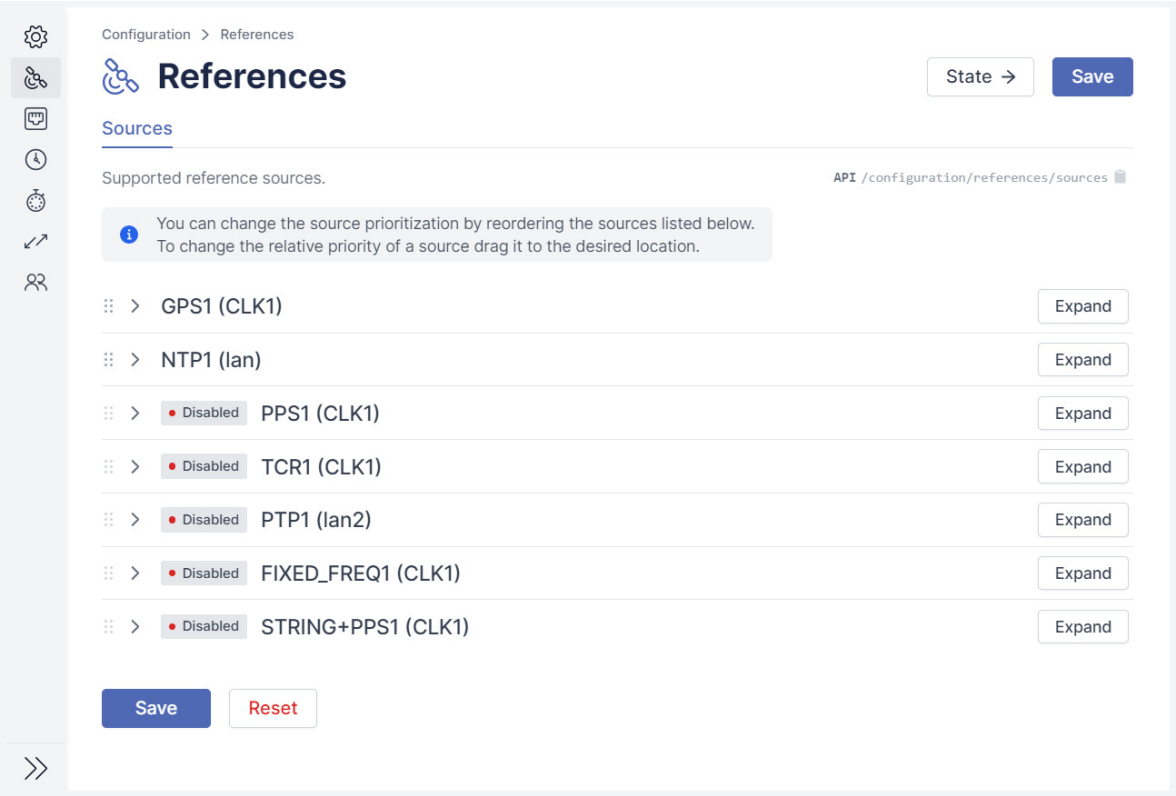

Figure 6.2: meinbergOS Web Interface: "Configuration → References" Tab

This list in this subsection (Fig. 6.2) allows you to prioritize the handling of input signals; the priorities dictate how clock switching is handled if a master reference ceases to be available. The prioritization of the input signals should be in descending order with respect to the accuracy of the signals.

The reference prioritization can be modified by dragging any reference to another position in the list.

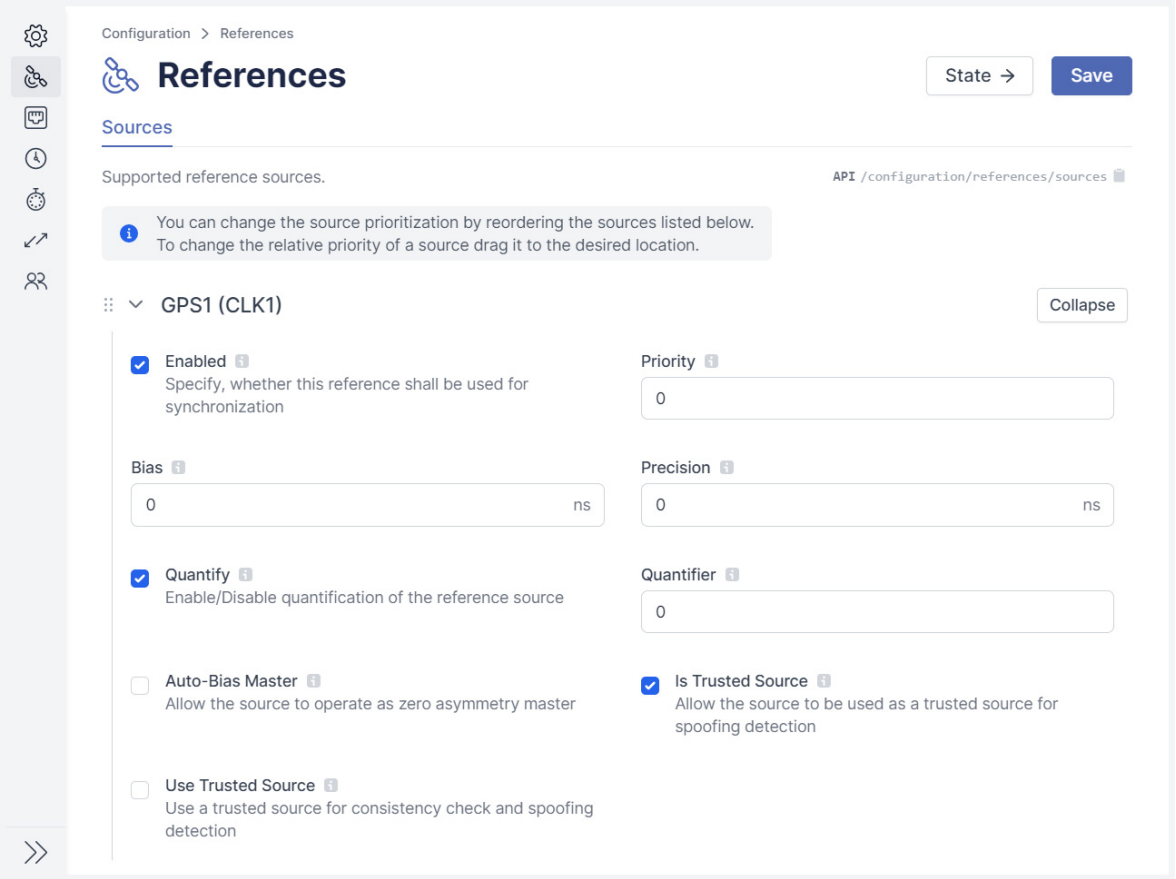

Figure 6.3: meinbergOS Web Interface: Expanded Reference Source

The configuration options for each reference source can be displayed by clicking on the panel or the corresponding **Expand** button (Fig. 6.2). This panel enables the available references of your meinbergOS device to be configured in detail.

An expanded panel can of course be collapsed again by clicking on the panel, or on the corresponding **Collapse** button (Fig. 6.3).

Enabled: Specifies whether this reference should be used for synchronization.

Priority: The priority index of the selected reference, which must be a unique value. The values are automatically renumbered to the lowest available value at the same priority level for ease of management (i.e., if a reference is set to Priority *6* and Priorities *3*, *4*, and *5* are still available, that reference will be renumbered to Priority *3*).

Bias: Used to specify a static delay offset (e.g., to account for path delays).

Precision: This parameter is used to define a manual precision value for this time reference.

When switching between different time sources, this value and the precision class of the oscillator is used to calculate a holdover time, after which the actual switchover is performed.

There is usually little point in switching straight from a more precise reference to a less precise one right after losing synchronization with a precise source.

If the time inaccuracy caused by a drift in the holdover source is less than the fundamental precision of next best available time reference, the most precise time

reference will continue to be used.

If, on the other hand, there is a time reference available with a higher priority and better **precision** value, it will be switched to immediately.

If the **precision** value is 0, no holdover period will be calculated and the reference will be switched immediately.

The switching algorithm calculates the appropriateness of switching using the following formula:

*(Precision of the next reference / precision of the current master) * (constant [s])*

The parameter *constant* here is dependent on the quality of the internal oscillator.

Quantify: Enables/disables quantification of the reference source (see **Quantifier** below).

Quantifier: The quantifier can be used to minimize switching operations between redundant clocks.

If a reference with a better priority and the same quantifier value becomes available on the currently unused clock, the system will continue using its current reference clock instead of switching to the other clock. This value is ignored in systems without redundant clocks.

Auto-Bias Master: Allows the source to operate as a zero-asymmetry master. **Auto-Bias Master** can be used to automatically determine static time offsets of other reference sources if the function **Auto-Bias Slave** is activated for those sources.

Auto-Bias Slave: (PTP only) Forces the slave to accept static bias correction from a zero-asymmetry master. If this function is activated, any static time offset of the time source can be compensated by measuring against a source with the **Auto-Bias Slave** function enabled.

Is Trusted Source: Designates the source as a **Trusted Source** for spoofing detection and consistency checks. See **Use Trusted Source** below for further information.

Use Trusted Source: Ensures that only a Trusted Source is used for consistency checking and spoofing detection. The Trusted Source functionality of meinbergOS ensures that only trusted reference sources are used to verify the integrity of a primary reference source's signal.

For example, if GPS is used as the primary reference source and the precision of this source exceeds *100 ns*, selecting **Use Trusted Source** will cross-reference the data with the next highest-priority reference which has **Is Trusted Source** enabled.

Therefore, sources considered to be beyond reproach (e.g., PPS) should be marked as **Is Trusted Source**, while primary sources considered to be "at risk" (e.g., GNSS) should be marked as **Use Trusted Source**.

Information:

The checkbox **Is Trusted Source** must be checked for at least one source for **Use Trusted Source** to have any effect.

Asymmetry Step Detection: (PTP only)

Asymmetry Step Detection is used to detect clock jumps. This function enables automatic bias correction in the event that a clock jump is detected so that the clock refrains from following this clock jump and instead tries to maintain its current phase. For this purpose, the time offset of the source (bias) will be re-measured.

6.2 Configuration - Network

In this subsection you can perform all of the main network configuration processes for your meinbergOS device.

Main: These are the main parameters for the general network configuration, notably the hostname, default gateways, and DNS servers.

Interfaces: This is where the physical network interfaces and associated virtual interfaces are managed. It also provides options for Synchronous Ethernet (SyncE) and the **Network** LED on the device itself.

PRP: The Parallel Redundancy Protocol (PRP) settings are used to set which physical network interfaces are connected to two redundant networks for a PRP implementation.

Bonding: The bonding options can be used to select the physical interfaces that you wish to use for link aggregation, and also enable selection of the bonding mode so that you can prioritize bandwidth optimization or interface redundancy as needed.

Extended Configuration: This is where manual network configuration entries are entered for your meinbergOS device (e.g., for static routing).

6.2.1 Configuration - Network - Main

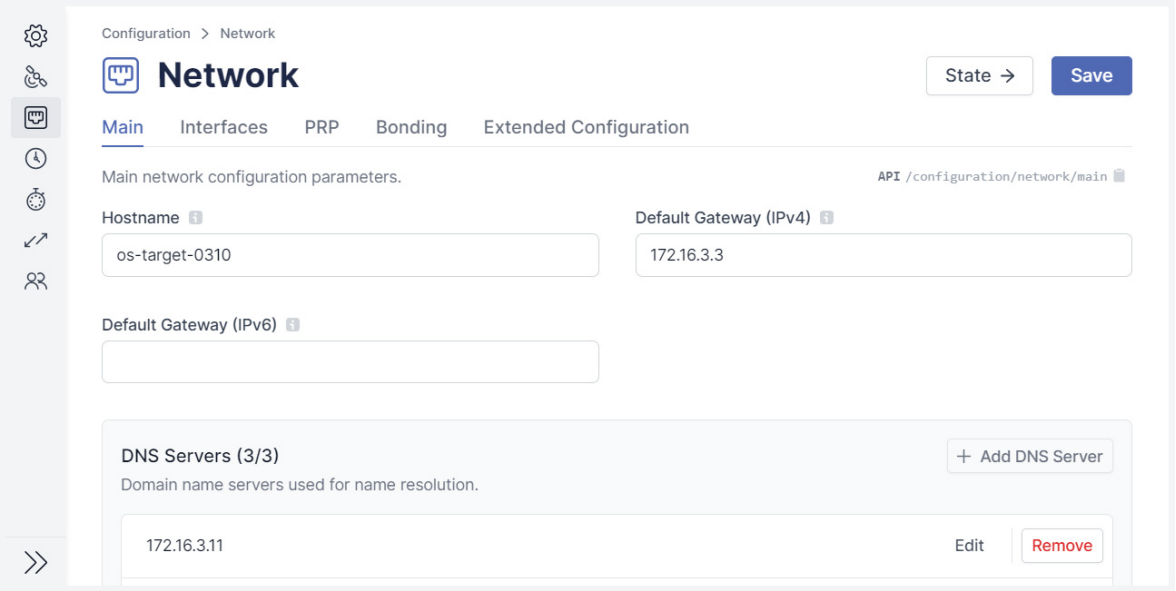

Figure 6.4: meinbergOS Web Interface: "Configuration → Network → Main" Tab

The "**Configuration → Network → Main**" tab (Fig. 6.4) is used to modify the essential network configuration for your meinbergOS device that enables it to actually reach other devices in the network.

Hostname: The hostname under which the meinbergOS device is advertised and can be found in the network. This can also be a fully qualified domain name (FQDN).

Standard Gateway (IPv4): System-wide default gateway for IPv4 addresses. This parameter allows you to configure a system-wide gateway to be used for IPv4.

A gateway only needs to be configured if network traffic needs to be routed between multiple different logical networks (subnets); in other words, if your meinbergOS device needs to communicate with other devices outside of the network it is located in.

The gateway for the subnet must be configured to allow the exchange of data traffic with other networks.

Standard Gateway (IPv6): System-wide default gateway for IPv6 addresses. This parameter allows you to configure an interface-specific gateway to be used for IPv6.

This configuration is only necessary if the IP address of the interface is not located in the same subnet as the default gateway.

DNS Servers: The domain name servers to be used for name resolution. Up to three DNS servers can be configured. These servers translate the hostname to an IP address to enable identification of an IP address based on that hostname.

A DNS server must be configured in particular if a hostname is specified elsewhere as the address of a network device, such as an external NTP server.

DNS Search Domain: Domains used to form fully qualified domain names when performing cleartext searches in DNS. You can specify up to three DNS search domains.

6.2.2 Configuration - Network - Interfaces

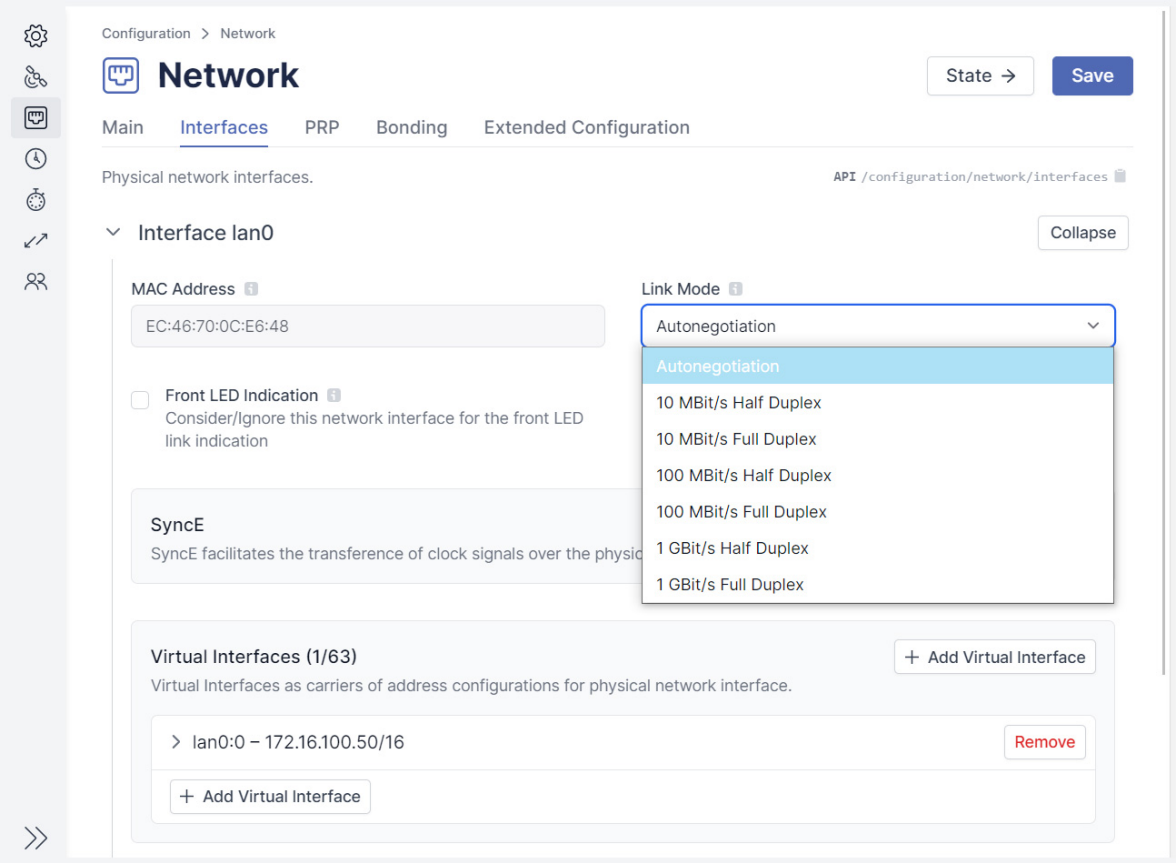

Figure 6.5: meinbergOS Web Interface: "Configuration → Network → Interfaces" Tab

The physical and virtual network interfaces and Synchronous Ethernet functionality are configured in this tab (Fig. 6.5).

Physical Network Interfaces

The available physical network interfaces are listed here and can be selected.

MAC Address: The Media Access Control (MAC) address—the unique identifier for a Network Interface Controller (NIC). This is used as a physical (OSI Layer 2) network address.

Link Mode: Transmission parameters that define the link speed and duplex mode; auto-negotiation enables two linked ports to negotiate the link speed and duplex mode automatically.

You can select one of seven available modes:

- *Autonegotiation* (automatic detection) (**default**)
- *10 Mbit/s Half Duplex* (10BaseT)
- *10 Mbit/s Full-Duplex* (10BaseT)
- *100 Mbit/s Half Duplex* (100BaseT)
- *100 Mbit/s Full Duplex* (100BaseT)
- *1 Gbit/s Half Duplex* (1000BaseT)
- *1 Gbit/s Full Duplex* (1000BaseT)

Front LED Indication: Specifies whether the state of this network interface should be indicated via the LED link indicator on the front of the device or not.

It is possible to have the link status of individual interfaces indicated visually via the LED on the front.

LED Indicator	Network Status	Front LED Status
Not activated	–	Yellow
Enabled for LAN 0 Interface (for example)	Link Up	Green
Enabled for LAN 0 Interface (for example)	Link Down	Red
Enabled for interfaces (such as LAN 0/LAN 1)	LAN 0: Link Up / LAN 1: Link Up	Green
Enabled for interfaces (such as LAN 0/LAN 1)	LAN 0: Link Up / LAN 1: Link Down	Red

SyncE

SyncE enables clock signals to be transmitted over the physical Ethernet layer. SyncE-specific parameters will be displayed once SyncE is enabled.

Information:

For more information regarding the SSM Quality Levels used in SyncE, refer to the appendix "SSM Quality Levels".

Active: Enables/disables SyncE for this network interface.

Quality Level Detection: If this function is enabled, the **Quality Level** is automatically detected based on the clock status. In *Master* mode, it is transmitted within the ESMC (Ethernet Synchronization Message Channel), while in *Slave* mode, it is used as the received level.

SDH Network Option: The selected values for the Quality Levels are dependent on the SDH network options: *Option 1* for SDH and E1-based systems, or *Option 2* for SONET and T1-based systems.

Fixed Input SSM: This is used to set a fixed **Quality Level** for the SyncE input signal.

Fixed Output SSM: This is used to set a fixed **Quality Level** for the SyncE output signal.

Minimum Input SSM: This specifies the minimum **Quality Level** of an input signal for it to be usable as a clock reference.

This is where you can select the lowest SSM **Quality Level** of the incoming signal (e.g., *QL-SSU-B*) that is considered acceptable as an incoming signal. If the clock reports a lower **Quality Level** (e.g., *QL-EEC1/SEC*) than the set minimum SSM **Quality Level**, the system will not use it for synchronization.

Local Priority: This is used to locally prioritize clocks in *Master* mode that have the same **Quality Level** and identical datasets. This can be done, for example, to manually prioritize a certain physical Ethernet port for SyncE even if **Quality Levels** are consistent among multiple sources.

RJ-45 GBit Clock Mode: When using RJ45 GBit copper links, the master and slave need to be defined.

A port can be used as a slave or as a master. SFP ports with fiber-optic connections can synchronize automatically in both directions and therefore do not need to be configured.

Virtual Interfaces

Virtual Interfaces are used to transport address configurations for physical network interfaces; it is possible to have to 63 Virtual Interfaces for each physical network interface.

Interface Label: A unique interface identifier to enable the state to be unambiguously attributed to the configuration addresses. This identifier must begin with the name of the physical interface (e.g., *lan2*) followed by a colon, then a meaningful suffix consisting of one or more letters or numbers (e.g., *lan2:ptp*). The complete virtual interface identifier must thus be at least six characters long. The name is case-sensitive.

DHCP: Dynamic Host Configuration Protocol (DHCP); this is used to have a server dynamically assign IPv4/IPv6 addresses as well as additional network parameters in the network.

If the DHCP option is enabled, the fields for static IP configuration will be disabled, as the address is automatically assigned by the DHCP server. It is still possible to configure a VLAN, however.

IP Address: This is the IPv4 or IPv6 address to be set manually for this virtual interface. If DHCP is enabled, this field will not be displayed, as the address is automatically assigned by the DHCP server.

Netmask / Prefix Bits: The number of prefix bits denoting the subnet address range within which the network address resides. If **DHCP** is enabled, this field will not be displayed, as the subnet address range is managed by the DHCP server.

Gateway: The interface-specific gateway for this virtual interface through which outbound traffic from that interface is routed to addresses outside of the subnet. If left empty, the virtual interface will route this traffic through the **Default Gateway** defined under "**Configuration** → **Network** → **Main**". If DHCP is enabled, this field will not be displayed, as the gateway is specified by the DHCP server.

Information:

The netmask in this case is not specified in decimal dot notation (e.g., *255.255.255.0*), but rather as the number of bits that define the address prefix of the subnet. For example, if your subnet encompasses the addresses *192.168.1.128* to *192.168.1.255* and your netmask in decimal dot notation is thus *255.255.255.128*, the first 25 bits of the subnet address range form the prefix.

VLAN: This checkbox enables VLAN tagging. VLANs ensure that network applications remain isolated from one another, despite being connected to the same physical network, without the need for multiple sets of cables and multiple devices.

VLAN ID: A 12-bit value (*0–4096*) that enables VLAN network traffic to be separated into discrete VLANs so that VLAN packets can be uniquely assigned to their respective VLANs.

VLAN Priority (PCP): A general priority level that relates to the IEEE 802.1p Class of Service (CoS). This can be used to prioritize VLAN packets.

Static Routes

Static routes to specified networks or hosts for this virtual interface. A static route can be defined by clicking on the **Add Static Route** button in the **Static Routes** panel inside the **Virtual Interfaces** panel.

Destination Type: Specifies whether this route points to a network or host address.

Destination Network: If *Network* is selected as the **Destination Type**, this is the network address that this route leads to.

Destination Host: If *Host* is selected as the **Destination Type**, this is the address to which this route leads.

Netmask / Prefix Bits: The number of prefix bits denoting the subnet address range within which the destination network address resides. The netmask is to be specified as the number of prefix bits, not in decimal dot notation. See note above for more information.

Gateway / Router Address: The address of the gateway/router used to route traffic to the specified network or host.

6.2.3 Configuration - Network - PRP

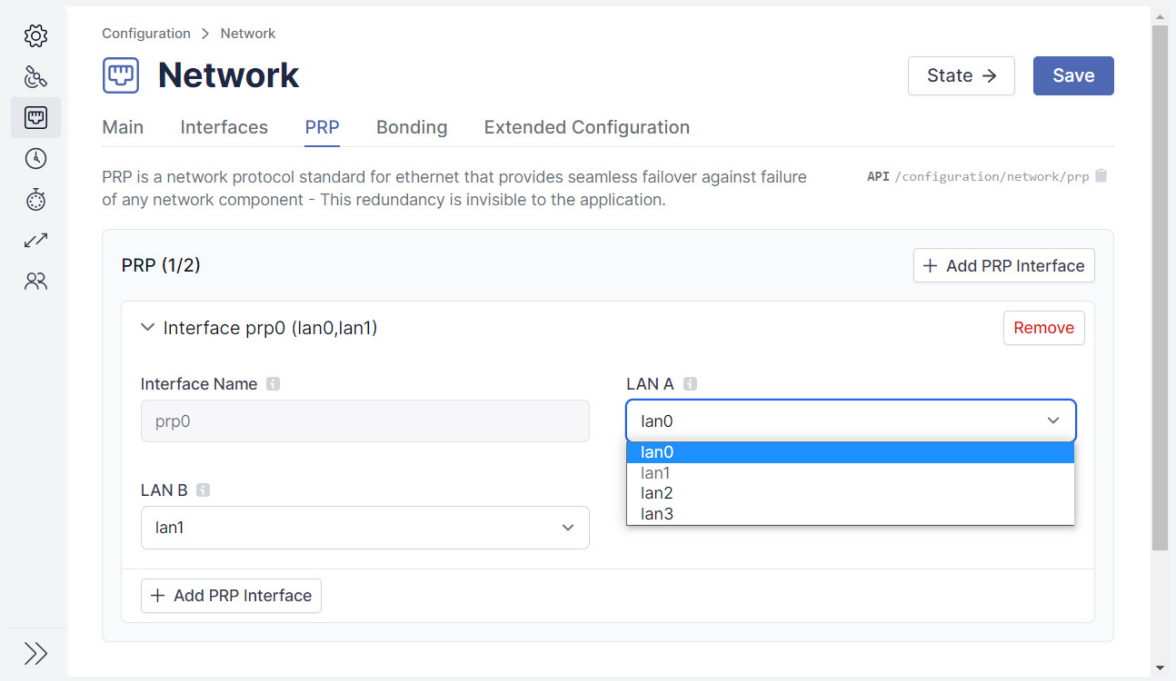

Figure 6.6: meinbergOS Web Interface: "Configuration → Network → PRP" Tab

PRP (Parallel Redundancy Protocol) is a network protocol standard for Ethernet networks that provides seamless failover to a redundant network in the event of the failure of any network component. This redundancy is invisible to applications.

PRP has been defined since 2010 in the standard IEC 62439-3. It is based on Layer 2 and was developed for computer networks that require a reliable solution to ensure high availability and operational capacity. A microSync, for example, is capable of operating as a DAN ("Dual Attached Node"), i.e., as a device that is connected to both redundant networks.

You can ensure network redundancy using the Layer 2 PRP protocol by connecting two separate network interfaces (e.g., *LAN 2* and *LAN 3* on a microSync) to two physically redundant networks, **LAN A** and **LAN B** (Fig. 6.6).

Interface Name: Name of the interface as specified by the Kernel.

It is possible to create one or multiple PRP interfaces; this enables, for example, the use of a microSync as a PRP end device to create one or more PRP networks.

LAN A: The physical interface that is connected to LAN A (lan0 - lan3).

LAN B: The physical interface that is connected to LAN B (lan0 - lan3).

To set up a redundant network with PRP support, the networks **LAN A** and **LAN B** each need to be assigned to their own network ports.

6.2.4 Configuration - Network - Bonding

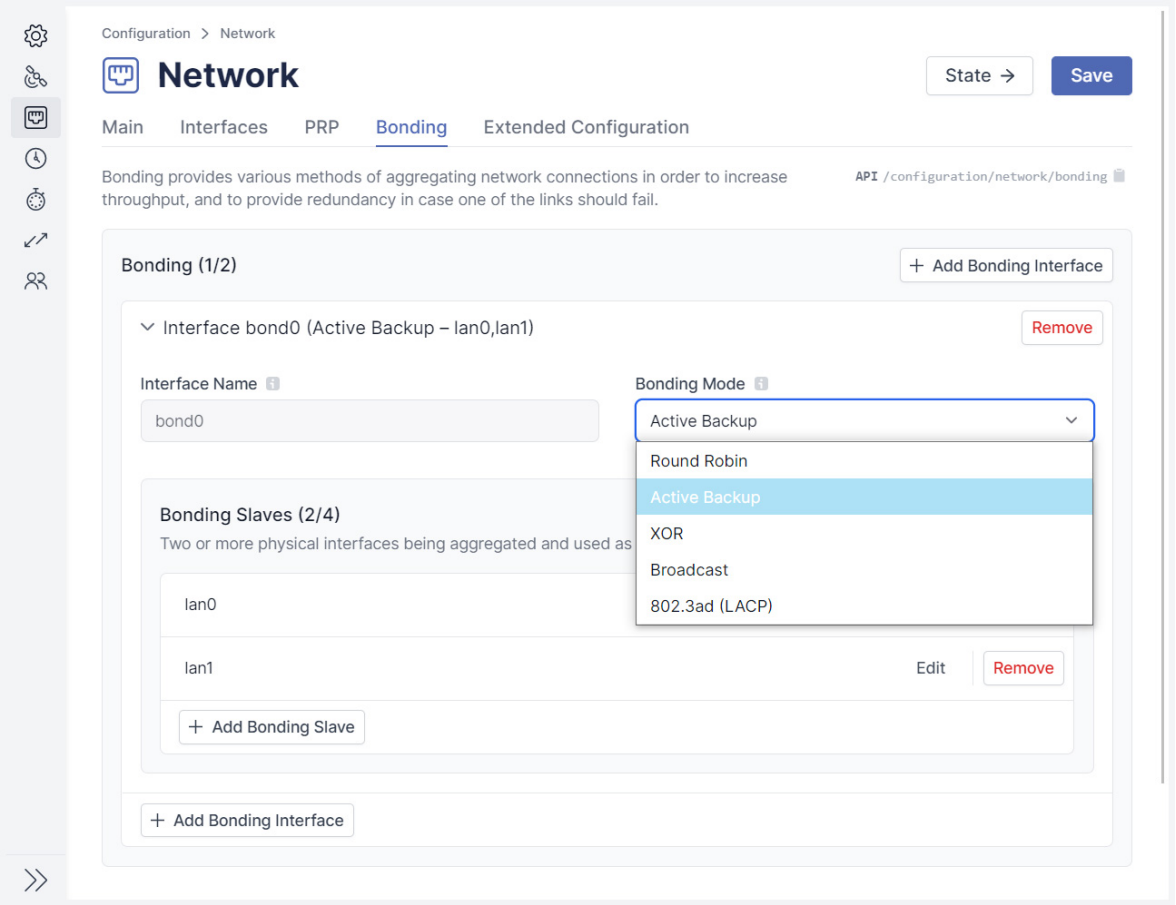

Figure 6.7: meinbergOS Web Interface: "Configuration → Network → Bonding" Tab

The tab "**Network** → **Bonding**" (Fig. 6.7) enables two or physical network connections to be bonded (grouped) into a single, joint interface.

Bonding mode is used to ensure physical interface redundancy or optimize the bandwidth usages of the interfaces. Various bonding modes are provided to suit your application requirements, and these are explained in more detail below.

Bonding Modes

Active Backup:
A physical interface in the bonding group acts as an "active slave". All network traffic in a meinbergOS device's bonding group passes through this interface. The other physical interfaces in the bonding group are passive. If the active interface loses its link-up, the bond will switch seamlessly to the passive interface, in which case the MAC address of the network interface will also remain unchanged.

Round Robin:
Packets are transmitted over each slave interface in sequence, starting with the first interface, ending with the last, then beginning from the first again. All interfaces must be connected to the same switch. The switch ports must be trunked.

This mode enables bandwidth optimization and provides fault tolerance.

XOR:
The transmitting interface is determined using an XOR hash of the MAC address of the destination and the MAC address of the source. All interfaces must be connected to the same switch. The switch ports must be trunked.

This mode enables bandwidth optimization and provides fault tolerance.

Broadcast:
All packets are transmitted to all interfaces. All interfaces must be connected to the same switch. The switch ports must be trunked.

This mode only provides fault tolerance and does not enable bandwidth optimization.

802.3ad (LACP):
802.3ad (Link Aggregation Control Protocol, LACP) enables multiple physical connections to be combined into a single, logical connection. This allows for load distribution while also providing better security than *Active Backup*, should an interface fail. Other connected network devices also need to support LACP in this case and the network ports must be configured accordingly.

6.2.5 Configuration - Network - Extended Configuration

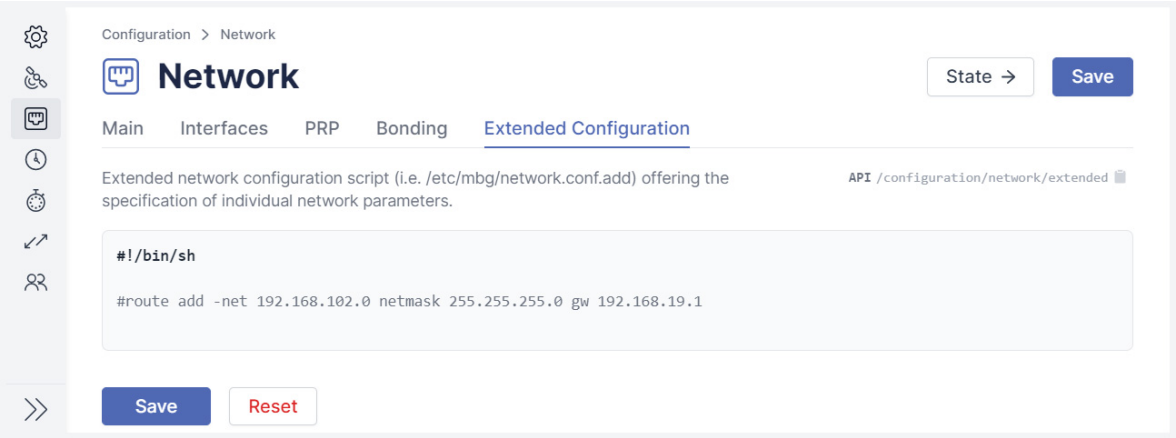

Figure 6.8: meinbergOS Web Interface: "Configuration → Network → Extended Network Configuration" Tab

The **Extended Configuration** tab (Fig. 6.8) is a basic text editor for an Extended Network Configuration Bash script that enables custom network parameters to be specified. This script is saved on the meinbergOS device's storage as */etc/mbg/network.conf.add* and is executed automatically each time the meinbergOS device is (re)booted or a change is made to a network-related configuration.

Important!

This subsection is intended solely for use by qualified system administrators and must be handled with care. Commands entered here will be executed as *root* user with the corresponding comprehensive rights. Improper usage of this input option may cause privileges to be improperly conferred upon other processes or users (privilege escalation), compromising the security of your meinbergOS device.

6.3 Configuration - NTP

This subsection provides the means to configure your meinbergOS device's NTP functionality. The type and number of configurable parameters depends on the module or device selected.

Server: This is where the meinbergOS device is configured in relation to how it operates as an NTP server.

Client: This tab provides configuration options for the meinbergOS operating as an NTP client or peer.

Symmetric Keys: Configuration options for NTP server/client authentication using symmetric MD5, SHA-1 and AES-128-CMAC keys are provided here.

Extended Configuration: This tab provides a text editor for entering custom NTP configuration parameters.

6.3.1 Configuration - NTP - Server

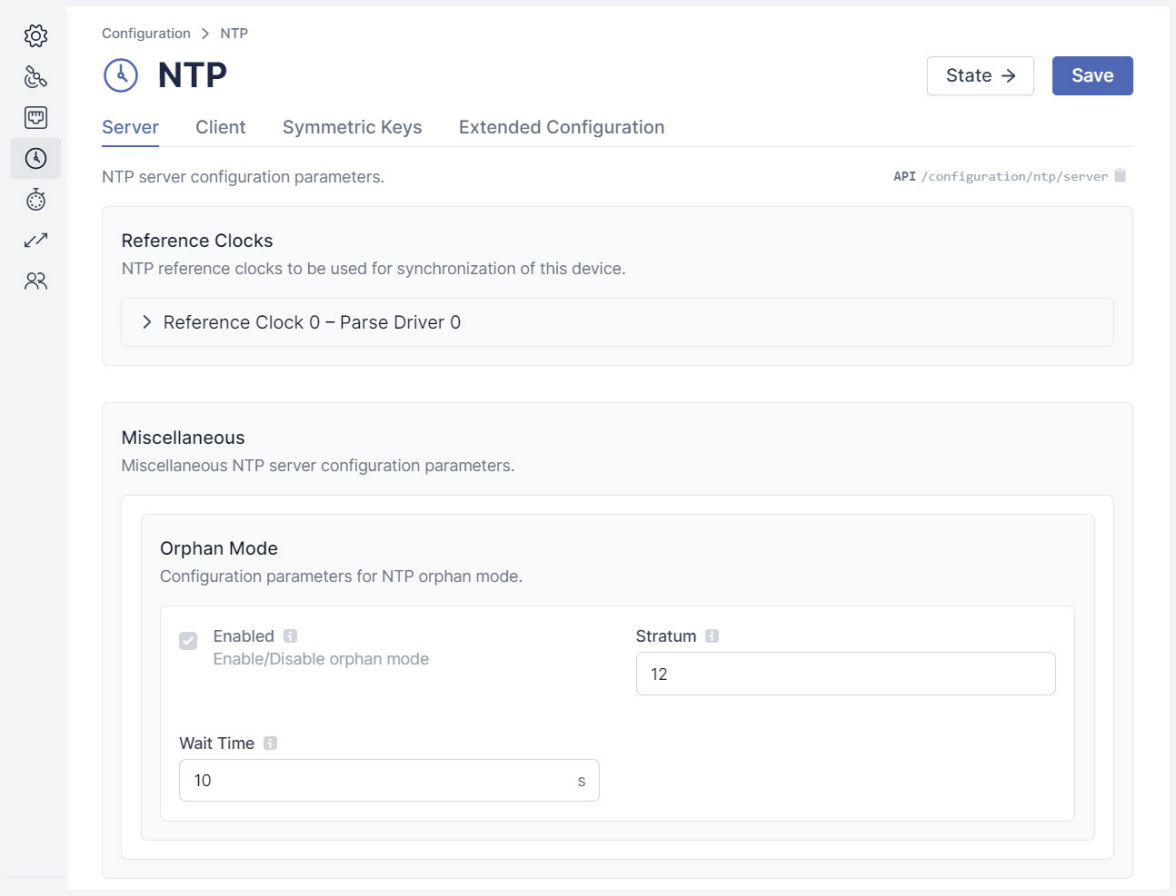

Figure 6.9: meinbergOS Web Interface: "Configuration → NTP → Server" Tab

Information:

These options relate to how your meinbergOS device operates as an NTP server or peer and not to your meinbergOS device as a client.

For the configuration of NTP server/client relationships where your meinbergOS device is the client, please open the subsection "**Configuration** → **NTP** → **Client**" and refer to the guidance provided in the corresponding chapter of this manual.

Information:

Many configuration options for the NTP server in this subsection are grayed out and are thus not editable. This is entirely normal as they relate solely to meinbergOS' internal handling of NTP traffic and there is no reason to adjust these. They are only displayed for reference purposes. This chapter will therefore only address the options that **are** editable.

Reference Clocks

The NTP reference clocks to be used to synchronize this device.

Time 2: Driver-specific **Time 2** for the reference clock (e.g., Trust Time).

For the Parse driver, this value specifies the **Trust Time** (provided that flag1 = 1 in */etc/ntpd.conf*).

The **Trust Time** specifies how long the NTP service will continue to 'trust' a desynchronized receiver to continue providing accurate time based on an oscillator that is in free-run mode. This period starts from the time at which the receiver ceases to be synchronized with its time source.

Trust Time is not supported for the reference clock if any driver other than the PARSE driver is used for the reference clock (e.g., NMEA driver, shared memory driver). There are reference clock drivers that do not support Trust Time, which is why the specified values may be interpreted differently.

Miscellaneous

Miscellaneous NTP server configuration parameters.

Orphan Mode: The configuration parameters for NTP Orphan Mode.

Orphan Mode is a 'fallback' mode that applies, for example, when a GPS receiver ceases to have reception. In this case, some NTP clients would expect the stratum value of this server to switch to a less favorable value while there is no GPS reception available. However, with NTPv4 clients, this is not necessary and may even be counterproductive.

The client recognizes that its time is drifting based on the increasing **root dispersion** value provided by the server's responses, and it can react by 'switching' to another server if one is available.

Stratum: The stratum level to be announced if no reference source is available.

This parameter's value specifies the stratum that NTP will announce in the network if the service has lost synchronization and the Trust Time has expired. Enter a custom value into this field, or leave it at the default value of 12.

The value **Time 2** (see above) should thus only be set for the purpose of adjusting the **Trust Time**.

You can set the stratum value to a less favorable stratum, but in general, this value should not be modified.

Wait Time: Time to wait until stratum demotion when **Orphan Mode** becomes active.

6.3.2 Configuration - NTP - Client

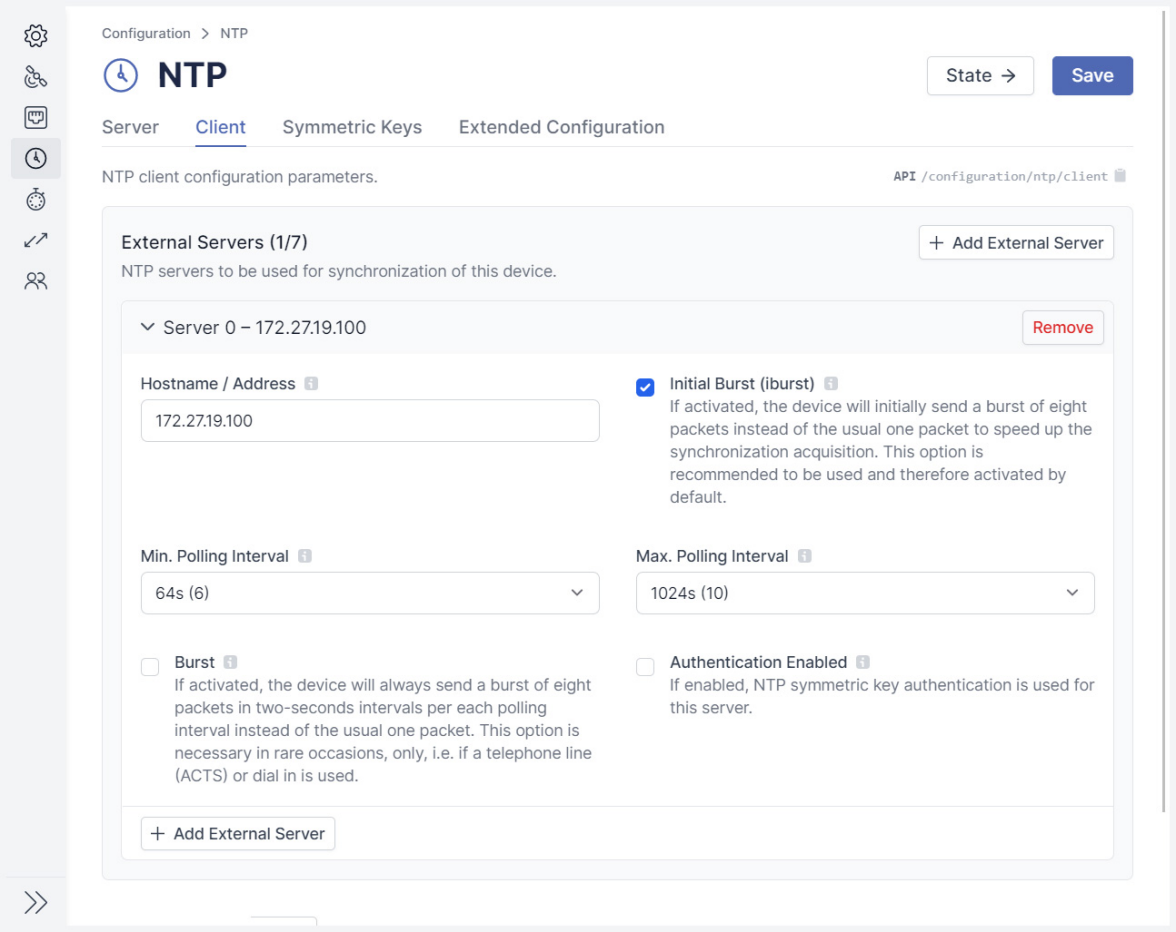

Figure 6.10: meinbergOS Web Interface: "Configuration → NTP → Client" Tab

Information:

These options relate to how your meinbergOS device operates as an NTP client and not to clients connected to your meinbergOS device (in its capacity as a server).

For the configuration of NTP server/client relationships where your meinbergOS device is the server, please open the subsection "**Configuration → NTP → Server**" and refer to the guidance provided in the corresponding chapter "**Configuration - NTP - Server**" of this manual.

External Servers

NTP servers to be used for synchronization of this device.

Hostname / Address: Hostname or IP address of the server.

Initial Burst (*iburst*): If enabled, the device will initially send a burst of eight packets instead of the usual one packet in order to speed up the synchronization acquisition. Enabling this option is recommended and it is therefore activated by default.

Min. Polling Interval: The minimum polling interval for NTP messages.

Max. Polling Interval: The maximum polling interval for NTP messages.

Burst: If enabled, the device will always send a burst of eight packets at two-second intervals upon each polling interval instead of the usual one packet. This option is only necessary on rare occasions, for example if a telephone line (ACTS) or dial-in is being used.

Authentication Enabled: If enabled, NTP symmetric key authentication will be used for this server.

Authentication Key ID: Only appears if **Authentication Enabled** is checked. This option allows you to select the trusted symmetric key to be used for NTP authentication.

6.3.3 Configuration - NTP - Symmetric Keys

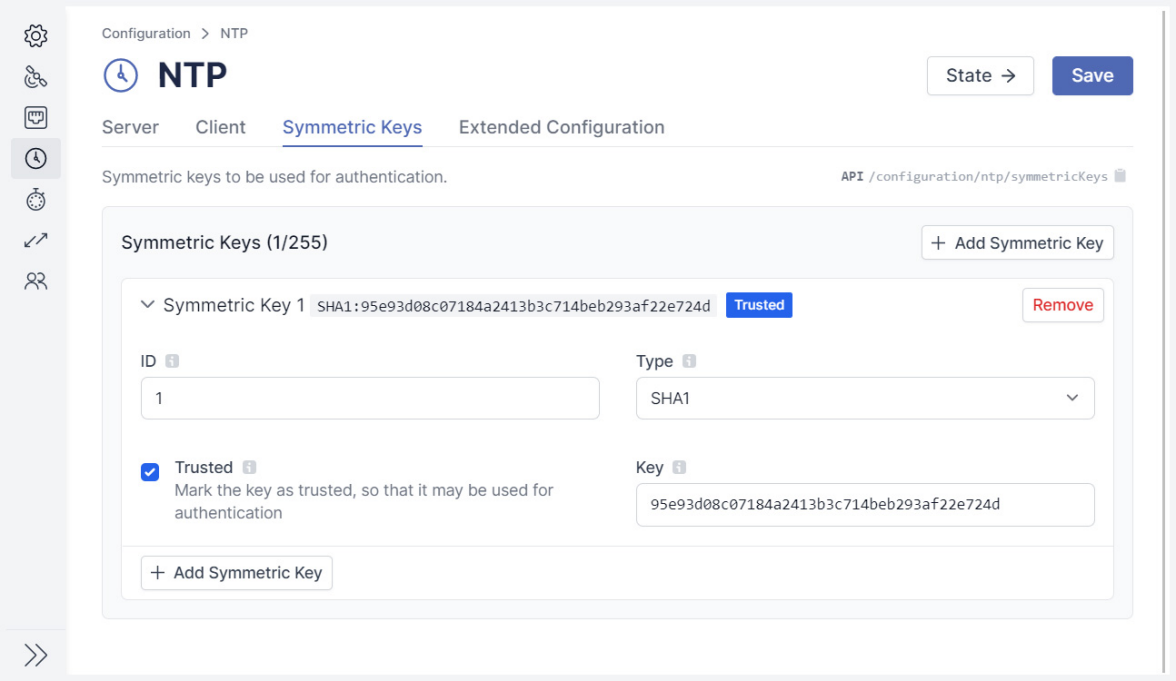

Figure 6.11: meinbergOS Web Interface: "Configuration → NTP → Symmetric Keys" Tab

This tab (Fig. 6.11) can be used to configure symmetric keys to provide authenticated NTP clock synchronization. The keys can be used both for communication with NTP clients and for communication with external servers. The system supports MD5, SHA-1 and AES-128-CMAC keys.

The button **Add Symmetric Key** is used to create a new entry for configuring a symmetric key.

ID: Unique ID of the symmetric key (*1–65535*). A symmetric key can be assigned an ID that will be used later to refer to this key when configuring trusted keys and external servers.

Type: The message-digest or cryptographic algorithm (*MD5*, *SHA-1*, or *AES-128 CMAC*) to be used for this key.

Trusted: This marks the configured symmetric key as **trusted** so that it can be used for authentication. If the device receives an NTP request from a key that is not recognized as **trusted**, the request will be rejected.

Key: The key phrase itself. Keys can consist of a series of up to 20 printable ASCII characters (except '#') or 40 hexadecimal characters (*0–9*, *A–F*).

6.3.4 Configuration - NTP - Extended Configuration

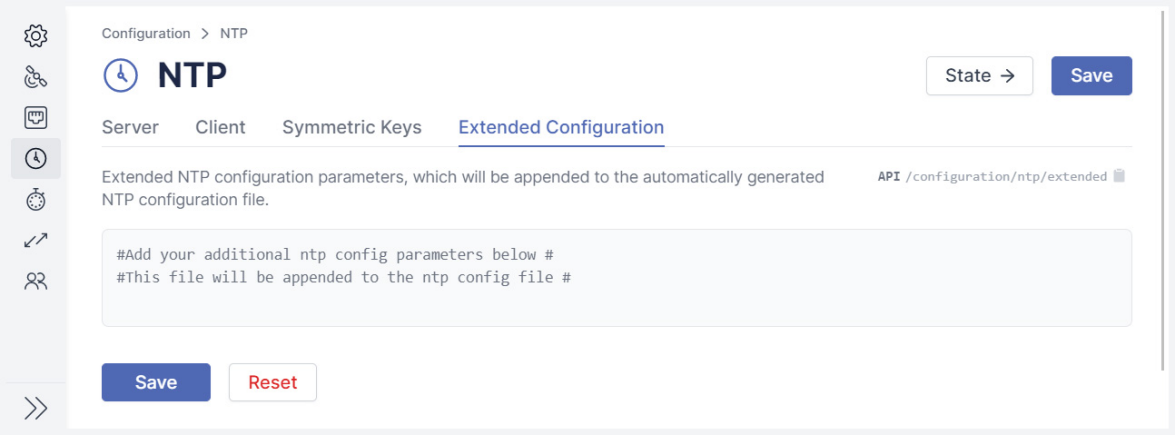

Figure 6.12: meinbergOS Web Interface: "Configuration → NTP → Extended Configuration" Tab

This tab (Fig. 6.12) enables you to add any custom configuration parameters that are not provided in the other configuration subsections. These parameters will be appended to *ntp.conf* after application of the main configuration.

6.4 Configuration - PTP

This subsection enables you to configure all of the main PTP parameters for your module or device. The level of configurability will depend on the interface/license.

Interfaces: This tab hosts the PTP-specific configuration options for the virtual network interfaces to be used for PTP applications.

Instances: This tab provides the configuration options for the PTP instances, including industry-specific profile settings.

6.4.1 Configuration - PTP - Interfaces

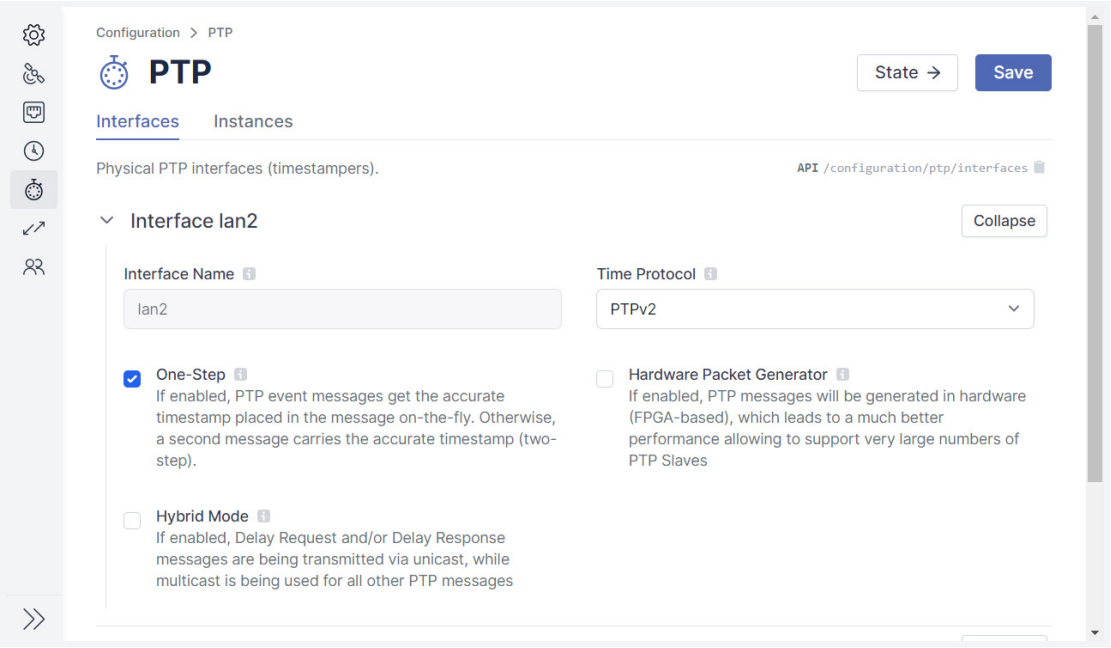

Figure 6.13: meinbergOS Web Interface: "Configuration → PTP → Interfaces" Tab

This tab (Fig. 6.13) is used to configure the PTP-specific parameters for the virtual interfaces used by the PTP instances.

Interface Name: Name of the physical PTP interface.

One-Step: If enabled, PTP event messages will have an accurate timestamp placed directly in the message on the fly. If disabled, the accurate timestamp will be transmitted in a second message (*two-step*).

Hardware Packet Generator: If enabled, PTP messages will be generated in hardware (FPGA-based). This can vastly improve performance and allow a very large number of slaves to be supported.

Information:

The Hardware Packet Generator is only compatible with one-step PTP and Layer 3 network protocols (UDP/IPv4 and UDP/IPv6). It can therefore not be used with any PTP profile that requires Layer 2 IEEE 802.3 communication.

Hybrid Mode: If enabled, **Delay Request** and/or **Delay Response** messages will be sent in unicast transmissions, while all other PTP messages will be sent as multicast transmissions.

6.4.2 Configuration - PTP - Instances

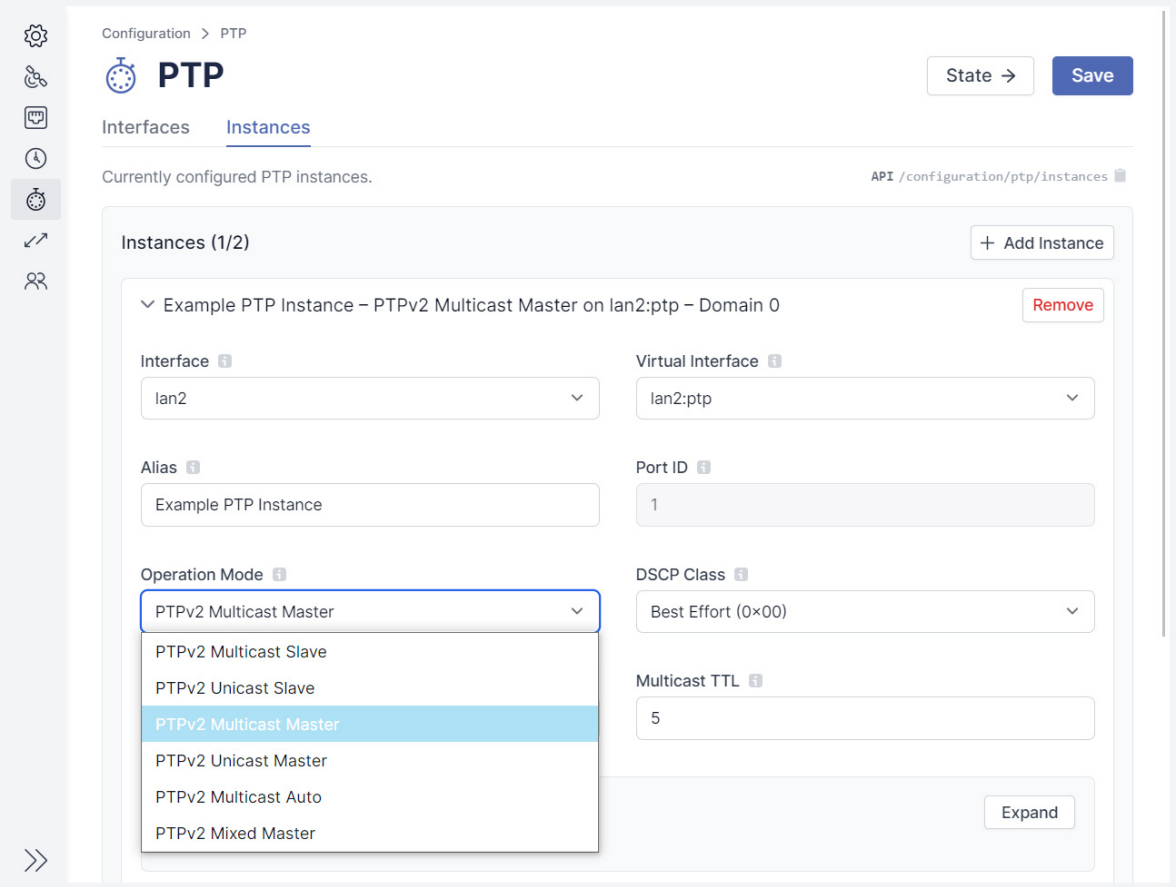

Figure 6.14: meinbergOS Web Interface: "Configuration → PTP → Instances" Tab

This tab (Fig. 6.14) is where the PTP instances are created, assigned to a pre-defined virtual interface, and (re)configured. Specifically, the configuration options listed here relate to the transmission and handling of PTP messages in the network functions. There are also a number of PTPv2-specific options when *PTPv2* is selected.

Interface: The physical PTP interface that this instance is running on.

Virtual Interface: The virtual interface (i.e., IP address) of the selected physical interface to be used by this instance.

Alias: An optional, descriptive name for this instance, purely for informational purposes.

Port ID: The read-only port ID of this instance, as assigned by the management process.

Operation Mode: This is used to select the appropriate operation role that the PTP stack should assume. The available options are dependent on the hardware support of the physical PTP interface.

The possible roles are:
- *Multicast Slave* (*lan2* only)
- *Unicast Slave* (*lan2* only)
- *Multicast Master* (*lan2* and *lan3*)
- *Unicast Master* (*lan2* and *lan3*)
- *Multicast Auto* (*lan2*)
- *Mixed Master* (*lan2* and *lan3*)

Information:

Unicast Slave mode requires the unicast masters to be entered manually in the **PTPv2** panel. See below for further information.

DSCP Class: 6-bit differentiated services code point (DSCP) in the **Differentiated Services** field of the IP header for packet classification purposes.

IPv6 Multicast Scope: The address range to be used for IPv6 multicast frames.

Unicast TTL: **TTL (time-to-live)** value for IPv4 or **hop count** limit for IPv6 unicast packets.

Multicast TTL: **TTL (time-to-live)** value for IPv4 or **hop count** limit for IPv6 multicast packets.

Delay Asymmetry Compensation: Enables/disables compensation for known delay asymmetry.

Asymmetry Compensation Value: If **Delay Asymmetry Compensation** is enabled, this specifies the offset to be applied by the instance to compensate for delay asymmetry in nanoseconds.

Enable Packet Counters: Enables/disables packet counter statistics. This data can be viewed under "**State** → **PTP** → **Instances** → **Packet Counters**". Refer to the chapter "State - PTP - Instances" for more information.

Log Level: The log level of the PTP instance. Valid values range from *0* (Error) to *4* (Debug).

Information:

The PTP stack logs are not accessible via the Web Interface or Meinberg Device Manager. The files must be acquired manually by logging into the meinbergOS device through a terminal, be it through SSH or a wired connection to the console interface. The log files are located at */var/log* and have the filename *ptpstack_<virtualinterfacename>.log*.

Temporarily Disabled: Select this option to temporarily disable an instance without removing its configuration.

PTPv2

Additional configuration parameters for PTPv2 instances.

Profile: Enables the selection of a specific PTP profile that sets specific operating parameters for defined PTP performance requirements.

Networking Protocol: The IP addressing protocol used for UDP/IP communication. This can be *UDP/IPv4* or *UDP/IPv6* communication (OSI Layer 3 communication). *IEEE 802.3* Layer 2 communication is also supported, but requires the FPGA-based Hardware Packet Generator to be disabled.

Domain: This is the domain number used for this PTP device. Only devices with the same domain number will communicate with each other in a network; this allows multiple PTP instances to be operated concurrently in isolation from one another within a single network.

Delay Mechanism: The delay measurement mechanism for path delay calculation. This can either be peer-to-peer (*P2P*) or end-to-end (*E2E*). The mechanisms available will depend on the selected profile.

Priority 1 (Master/ Auto Mode only): This field is used by the PTP Best Master Clock algorithm for selection of the grandmaster. Conventionally this is set at *128* for devices designed to serve as master clocks and *255* for devices designed to serve exclusively as slaves, but can be fine-tuned if you wish to define priorities among multiple individual master clocks.

Priority 2 (Master/ Auto Mode only): This field is also used by the PTP Best Master Clock algorithm for selection of the grandmaster, but is only considered by the algorithm if the **Clock Class**, **Accuracy**, and **Variance** values are essentially identical. This value is generally used to determine which master clocks serve as primary and backup clocks when multiple redundant master clocks are in place.

Announce Receipt Timeout: Establishes how many **Announce** intervals the receiving device will wait until it stops listening for **Announce** messages.

Announce Interval: Specifies the requested average interval between **Announce** messages.

Sync Interval: Specifies the requested average interval between **Sync** messages.

(Peer) Delay Request Interval: Specifies the minimum interval at which **Delay Request** messages should be sent from PTP master to slave or between peers.

Enable PTP Timescale: Specifies whether the standard PTP timescale (TAI) should be used (checkbox enabled) or if an arbitrary timescale should be applied instead (checkbox disabled). This will be grayed out if the selected profile mandates the use of the TAI timescale.

Enable Path Trace TLV (Master/Auto Mode only): If enabled, this option will cause PTP messages to follow a Path Trace TLV.

Enable V1 Hardware Compatibility (Master/ Auto Mode only): This should be enabled if using PTP clocks in a network that only support PTPv1. This causes sync messages to be padded with enough bytes to ensure that the messages meet the PTPv1 message size requirement. Enabling this will increase the bandwidth requirement.

Enable Management Messages: Enabling this checkbox will cause PTP Management Messages to be sent and parsed. Disabling it will cause **all** Management Messages to be ignored.

PTPv2 Fixed Quality

If *Master* or *Auto* mode is selected, the **Fixed Quality** parameters can be opened within the **PTPv2** panel to enable the quality parameters to be forced for the Best Master Clock algorithm. These settings do not appear or apply in *Slave* mode.

Information:

It is possible to have only individual quality parameters forced and the remainder calculated automatically. Parameters that are to be left unforced (calculated automatically) should be set (or left at) a value of *0*.

Clock Class (Sync): Specifies which fixed BMC **Clock Class** is to be reported while the meinbergOS device is synchronized with its reference.

Clock Class (Holdover): Specifies which fixed BMC **Clock Class** is to be reported while the meinbergOS device is still (re)synchronizing.

Clock Class (Free Running): Specifies which fixed BMC **Clock Class** is to be reported while the meinbergOS device is in free-run mode (running solely off the oscillator).

Clock Accuracy: Specifies which BMC **Clock Accuracy** is to be reported.

Clock Variance: Specifies which BMC **Clock Variance** is to be reported.

Time Source: Specifies what type of Time Source the clock declares itself to be.

PTPv2 Unicast Masters

Instances operating as a unicast slave require the manual entry of the unicast masters that the slave will use for synchronization. These can be entered in this panel by clicking on **Add Unicast Master**.

Address: Specifies the address of the unicast master. This can be the MAC address or, if using *UDP/IPv4* or *UDP/IPv6*, the IP address.

Clock ID: Specifies the PTP **Clock ID** of the unicast master. If this ID is unknown, you may enter the wildcard ID *ff:ff:ff:ff:ff:ff:ff:ff*.

Port ID: Specifies the **port ID** of the unicast master. If the port is unknown, you may enter the wildcard port *65535*.

Announce Interval: The interval to be requested of the unicast master for **Announce** messages.

Sync Interval: The interval to be requested of the unicast master for **Sync** messages.

Delay Request Interval: The interval to be requested of the unicast master for **Delay Request** messages.

Transmission Duration: Specifies how long in seconds **Announce**, **Sync**, and **Delay Request** messages may be requested for before the subscription must be renewed by the device.

6.4.2.1 Guide: Creating a PTP Instance

Because the process of setting a PTP instance on an interface is rather more involved than the configuration of NTP or other signal outputs, this chapter will briefly explain how to create a PTP instance and assign it to a virtual interface.

1. Create a virtual network interface by opening "**Configuration** → **Network** → **Interfaces**", selecting the physical interface that you wish to create a new virtual interface on, and then clicking on **Add Virtual Interface**. Proceed as described in the chapter "**Configuration - Network - Interfaces**". Please ensure that you select an interface that supports PTP.

2. Configure the PTP interface by opening "**Configuration** → **PTP** → **Interfaces**", opening the panel for the corresponding physical interface. Define whether you wish to use *one-step* or *two-step* message transmission (depending on your network configuration), hardware packet generation, and hybrid unicast/multicast transmission for PTP messages. For more information, refer to the chapter "**Configuration - PTP - Interfaces**".

3. Configure the PTP instance by opening "**Configuration** → **PTP** → **Instances**". Select the physical interface, the virtual interface on that physical interface that you have just created, and configure the instance accordingly as described in the chapter "**Configuration - PTP - Instances**".

6.5 Configuration - IO Ports

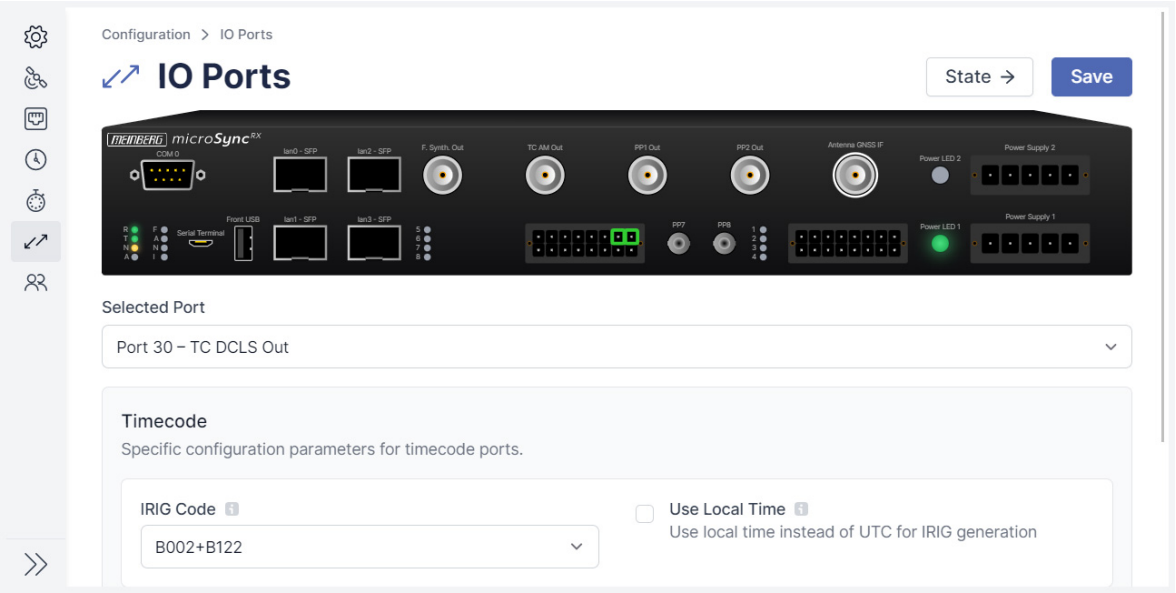

Figure 6.15: meinbergOS Web Interface: "Configuration → IO Ports" Subsection

This subsection (Fig. 6.15) provides an overview of the available interfaces and visual status indicators on the front of your meinbergOS device (e.g., a microSync).

Selecting a interface, plug, or socket will open the corresponding panel or subsection used to configure that connector (if configurable).

The interfaces shown in this subsection will vary depending on the specific meinbergOS device. Therefore, please refer to your meinbergOS device's manual for further information.

6.6 Configuration - Users

The "**Configuration** → **Users**" subsection can be used to create new users and to edit or delete existing users. oder gelöscht werden.

Accounts: This tab is where the meinbergOS device's user accounts are managed. It provides functions for creating and deleting accounts as well as assigning or revoking permissions.

Levels: This tab provides the ability to manage templates for the creation of new user accounts.

Important!

The **Users** subsection is only visible to users with the **Read Configuration** permission for **Users** and can only be modified by accounts with the **Write Configuration** permission for **Users**. Accordingly, new accounts can also only be created and existing accounts can only be deleted by accounts with the **Write Configuration** permission for **Users**.

It is therefore essential for at least one accessible account to always have **Write Configuration** permissions for **Users**. If no accounts have **Write Configuration** permissions for **Users**, it will become impossible to create or delete accounts and you may be permanently locked out of certain functions.

6.6.1 Configuration - Users - Accounts

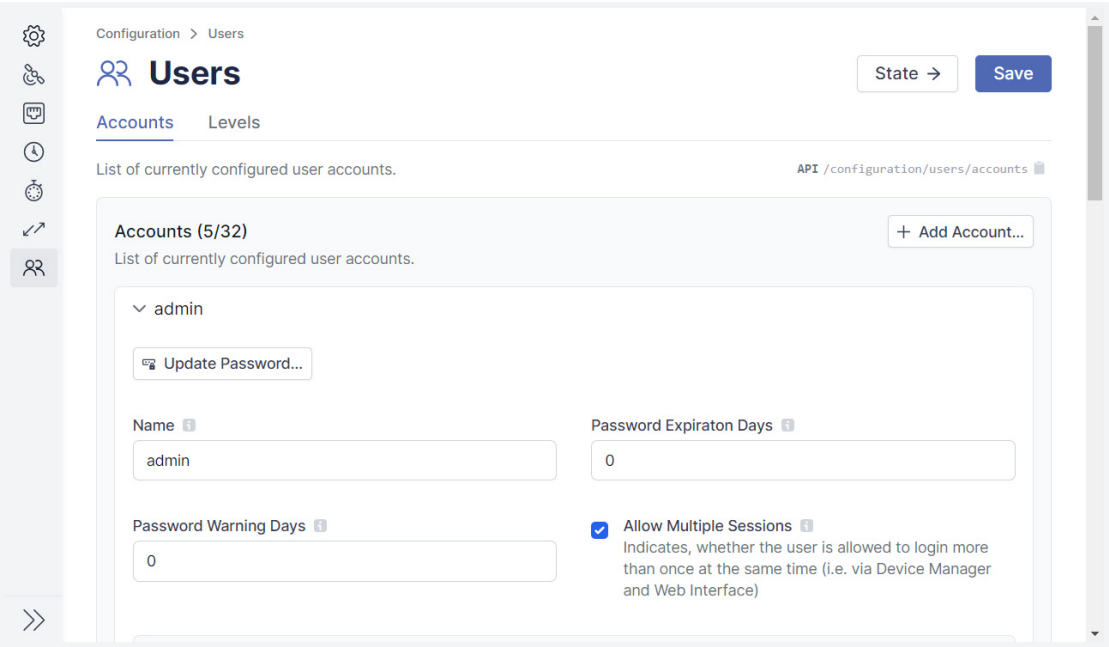

Figure 6.16: meinbergOS Web Interface: "Configuration → Users → Accounts" Tab

Important!

Assigning the **Write Configuration** permission **Users** to any account will enable that account to modify not only their own permissions but also the permission of **every** account on that system. This permission should therefore only ever be assigned to users who are completely trusted.

The following settings can be modified in this tab (Fig. 6.16):

Name: The unique name of the user account.

Password Expiration Days: The number of days after which the password becomes invalid (*0* = Never).

Password Warning Days: The number of days after which the user is to be warned that their account password will be expiring imminently (*0* = Never).

Allow Multiple Sessions: Specifies whether the account can be used to log in more than once at the same time (for example, one via Meinberg Device Manager, another via the Web Interface).

Channels: Specifies the channels via which this account can connect to the device:
- *Web Interface*
- *Device Manager*
- *Shell*
- *SNMP*

An **Admin** account can be used to assign the channels to each account based on the user's specific needs.

Allow "sudo" in Shell: Specifies whether the account is allowed to gain elevated privileges in a shell session by using the **sudo** tool.

Channels

The channels specify which interfaces the user may use to connect and interact with the meinbergOS device.

Web Interface: Allows access to the meinbergOS Web Interface via a web browser.

Device Manager: Allows access to the meinbergOS device using Meinberg Device Manager.

Shell: Allows access to the Linux command line interface (CLI) via terminal software. This channel is also required for viewing the system log and kernel log, even through the meinbergOS Web Interface.

SNMP: Allows access to the meinbergOS device's SNMP interface for remote monitoring and control of the meinbergOS device using an SNMP tool.

User Permissions

Specifies the read and write permissions of this user.

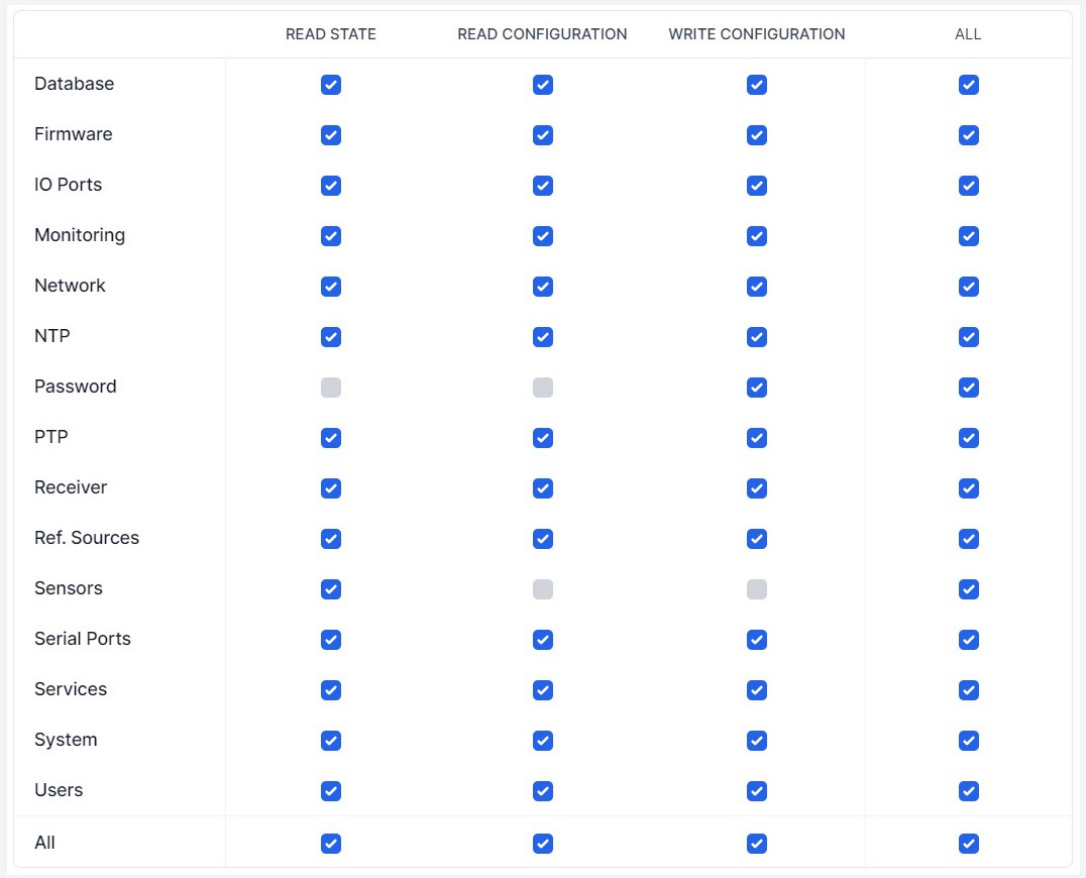

Figure 6.17: meinbergOS Web Interface: User Permissions

Database:

Read Configuration:
This currently has no function.

Write Configuration:
Allows the user to reset the satellite statistics database. This process is performed using Meinberg Device Manager and is currently not possible in the meinbergOS Web Interface.

Read State:
This currently has no function.

Information:

Access to the satellite statistics database in Meinberg Device Manager also requires access to the **Shell** channel and the **Allow "sudo" in Shell** permission.

Firmware:

Read Configuration:
Provides access to view all meinbergOS firmware information, including information on the currently active firmware build, the clock module firmware, and the installed firmware versions.

Write Configuration:
Allows the user to select one of the installed firmware versions and to install new versions.

IO Ports:

Read Configuration:
Allows the user to view the physical I/O port configuration options and status information from the Configuration section including input/output signal specifications and communication protocols (except Ethernet ports, which are governed by **Network** permissions).

Write Configuration:
Specifies the ability to modify the communication/output settings of the physical I/O ports (except Ethernet ports, which are governed by **Network** permissions).

Read State:
Allows the user to view the same information as with the **Read Configuration** permission, but must be accessed from the **State** section.

Monitoring:

Read Configuration:
Grants the account access to the **Monitoring** configuration tab in Meinberg Device Manager, allowing it to read the SNMP, syslog, and events monitoring configurations through Meinberg Device Manager. This is currently not possible through the meinbergOS Web Interface.

Write Configuration:
Allows the user to modify the settings of the **Monitoring** configuration tab in Meinberg Device Manager, allowing it to modify the SNMP, syslog, and events monitoring configurations through Meinberg Device Manager. This is currently not possible through the meinbergOS Web Interface.

Information:

SNMP, syslog, and events monitoring currently cannot be configured through the meinbergOS Web Interface.

Read State:
Provides access to the **Monitoring** status tab in Meinberg Device Manager. Much of the information contained therein is already provided on the Web Interface Dashboard even without this permission.

NTP:

Read Configuration:
Allows the user to view (but not modify) the configuration options for the NTP service available in the **Configuration** section.

Write Configuration:
Allows the user to modify the configuration options for the NTP service available in the **Configuration** section.

Read State:
Allows the user to open the **NTP** subsection in the **State** section and thus view NTP-related status information.

Network:

Read Configuration:
Allows the user to view (but not modify) the configuration options for network connectivity available in the **Configuration** section.

Write Configuration:
Allows the user to modify the configuration options for network connectivity available in the **Configuration** section.

Read State:
Allows the user to open the **Network** subsection in the **State** section and thus view network-related status information.

PTP:

Read Configuration:
Allows the user to view (but not modify) the configuration options for the PTP service available in the **Configuration** section.

Write Configuration:
Allows the user to modify the configuration options for the PTP service available in the **Configuration** section.

Read State:
Allows the user to open the **PTP** subsection in the **State** section and thus view PTP-related status information.

Password:

Write Configuration:
Specifies whether the user is permitted to modify the account's password.

Receiver:

Read Configuration:
Allows the user to view (but not modify) options related to the internal clock module in Meinberg Device Manager. These options are currently not accessible via the meinbergOS Web Interface.

Write Configuration:
Allows the user to modify options related to the internal clock module in Meinberg Device Manager. This permission does not affect access to configuration options in the meinbergOS Web Interface; some of these options (simulation mode, compensation for cable length) are also available via the **IO Ports** permission.

Read State:
Allows the user to open the **Clock Module** subsection in the **State** section and thus view status information related to the receiver, such as information on its antenna connection and satellite reception.

Information:

It is possible to enable Simulation Mode and compensation for cable length-related signal propagation delays via the **IO Ports** configuration subsection and thus with the **IO Ports** configuration permissions.

Ref. Sources:

Read Configuration:
Allows the user to view (but not modify) the configuration options for the reference sources available in the **Configuration** section.

Write Configuration:
Allows the user to modify the configuration options for the reference sources available in the **Configuration** section.

Read State:
Allows the user to open the **References** subsection in the **State** section and thus view status information related to the reference sources.

Sensors:

Read State:
Provides access to hardware temperature readings viewable in Meinberg Device Manager.

Information:

Temperature sensor information is currently not available in the meinbergOS Web Interface.

Serial Ports:

Read Configuration:
This permission is required to provide the user with read access to the **IO Ports** configuration options in the meinbergOS Web Interface.

Write Configuration:
This permission is required to provide the user with write access to the **IO Ports** configuration options in the meinbergOS Web Interface.

Information:

The **Serial Ports** permissions, which govern access to the time string output from the serial ports, and the **IO Ports** permissions, which govern access to the I/O ports in general, provide access to different options when using Meinberg Device Manager, but these options are combined in a single subsection in the meinbergOS Web Interface. It is therefore necessary to have both **Read Config** and/or both **Write Config** permissions activated if a user is intended to access and/or make changes in the **IO Ports** configuration subsection.

Services:

Read Configuration:
This permission affects access to certain options available in Meinberg Device Manager relating to the control of the SNMP, Web Interface, and NTP services.

Write Configuration:
This permission mostly relates to the ability to modify certain options in Meinberg Device Manager relating to the control of the SNMP, Web Interface, and NTP services. For the purposes of the meinbergOS Web Interface, it is required to restart the NTP service from the **Maintenance** section. Refer to "**Maintenance**" for more information.

Information:

With the exception of the **Restart NTP** function provided in the **Maintenance** subsection, the functions that the **Services** permissions relate to are currently only accessible from Meinberg Device Manager and are currently not accessible via the meinbergOS Web Interface.

System:

Read Configuration:
This permission does not have any bearing on the functions of the meinbergOS Web Interface. It only affects access to the **System** sections of Meinberg Device Manager, which are used to create system snapshots and upload SSL certificates.

Write Configuration:
This permission relates to the execution of system-wide maintenance operations, specifically rebooting, saving the current configuration as the Startup Configuration, recovering the Startup Configuration by discarding the current configuration, and performing a factory reset. It is also required to download a diagnostics file.

Read State:
This permission relates to the display of the **System** tile on the Dashboard and the **Overview** subsection of the **Maintenance** section, both of which contain hardware-related information such as the serial number. This permission is also required to view the system log and kernel log.

Information:

A user without the **System Write** permission cannot save changes to the Startup Configuration, so any changes made by that user to the configuration will be lost if the system is rebooted or unexpectedly powered down, unless another user with the appropriate permission logs in to save the Startup Configuration.

Users:

Read State/Read Configuration:
Specifies whether the user is permitted to view configuration information for all users on the system.

Write Configuration:
Specifies whether the user is permitted to create new users and modify the configuration of existing users.

6.6.2 Configuration - Users - Levels

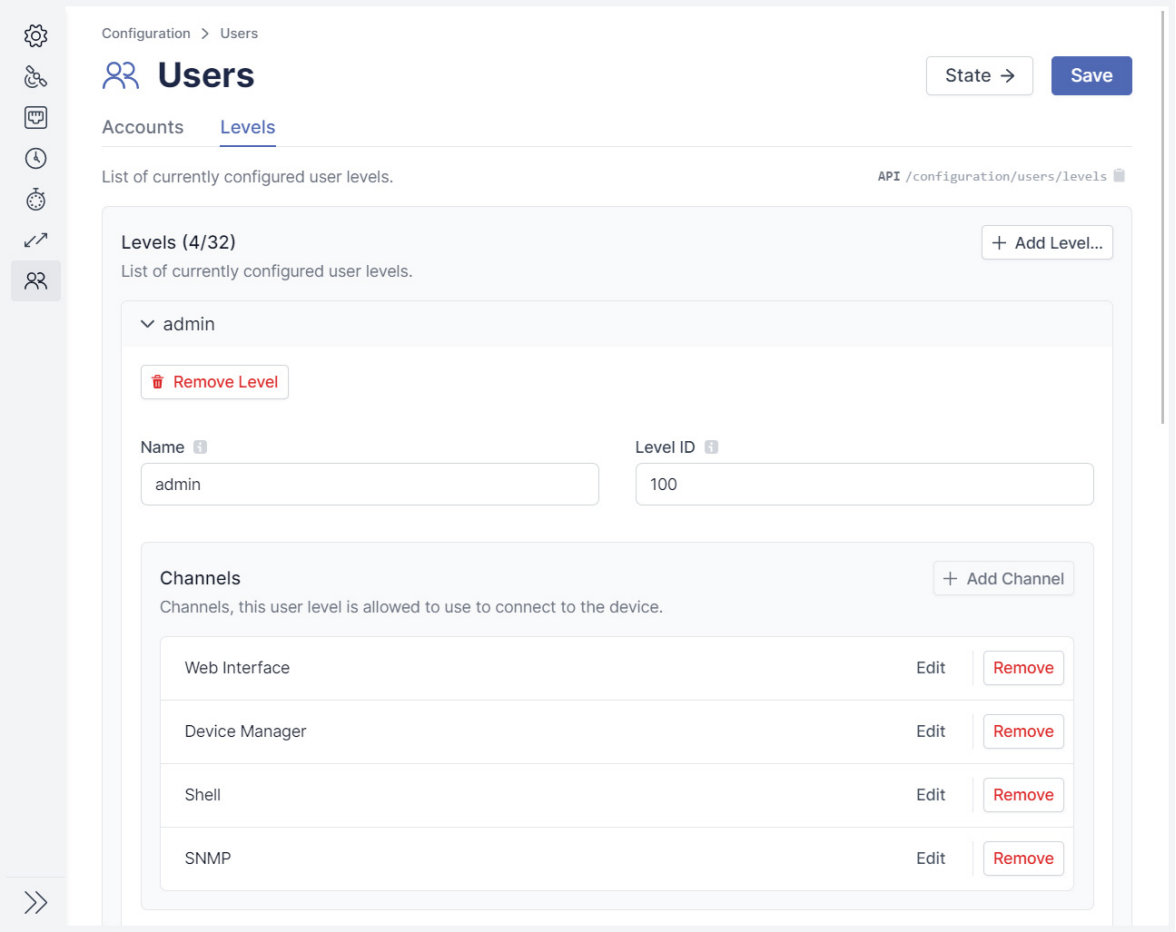

Figure 6.18: meinbergOS Web Interface: "Configuration → Users → Accounts" Tab

The "**Configuration → Users → Levels**" tab (Fig. 6.18) is used to define or modify user levels to enable more efficient creation of user accounts. User levels are essentially customized user profiles that serve as templates for the creation of new user accounts. When a new user account is created, one of these levels can be selected so that the new user account inherits the level's permissions configuration.

Important!

User accounts only inherit a level's defined configuration upon creation of that account. Any changes made to the level template after the fact will not be carried over to existing accounts created using that level. Therefore, please note that this function cannot be used to add or revoke permissions to multiple users concurrently and/or retroactively.

The button **Add Level** can be used to add a new level, while the **Levels** panel shows the list of currently defined levels, each of which can be expanded and collapsed as necessary.

Name: The unique name of the user level.

Level ID: The unique ID (*0–999*) of the user level.

Channels: The channels that this user level is allowed to use to connect to the device.

Channels

The channels specify which interfaces the user may use to connect and interact with the meinbergOS device.

Web Interface: Allows access to the meinbergOS Web Interface via a web browser.

Device Manager: Allows access to the meinbergOS device using Meinberg Device Manager.

Shell: Allows access to the Linux command line interface (CLI) via terminal software. This channel is also required for viewing the system log and kernel log, even through the meinbergOS Web Interface.

SNMP: Allows access to the meinbergOS device's SNMP interface for remote monitoring and control of the meinbergOS device using an SNMP tool.

Important!

Removing Web Interface access from the current user account will cause the account to be immediately logged out, and it will only be possible to regain access either through another account or via a channel that has been enabled for the modified account!

7 State

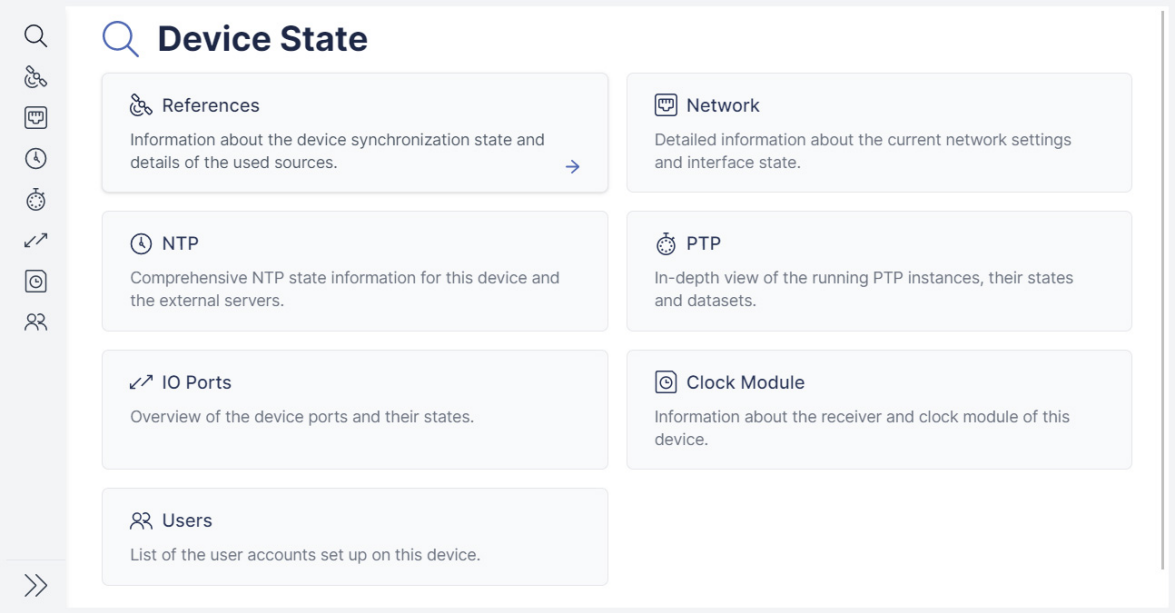

Figure 7.1: meinbergOS Web Interface: "State" Section

The **State** section of the meinbergOS Web Interface (Fig. 7.1) provides you with a wealth of information about the status of your microSync device, including an overview of the various reference sources, network connectivity and redundancy, NTP and PTP functionality, I/O ports, and user access.

Note:

The pages for these subsections are regularly refreshed automatically. If you wish to disable this automatic refresh for a specific page for any reason, you can do so by clicking on the link **Disable auto-refresh** at the top of each page. The auto-refresh will then remain disabled for that page even after it is closed, until it is actively re-enabled for that page.

7.1 State - References

The "**State** → **References**" subsection provides general information about the system's reference clocks, including the signal availability and phase lock, accuracy, and jitter status.

Overview: This tab provides a list of all available references, both enabled and disabled, showing their availability, offset, and other states.

Global: This tab provides more detailed information on the current master reference.

Sources: This tab provides more detailed information on all of the available reference sources.

7.1.1 State - References - Overview

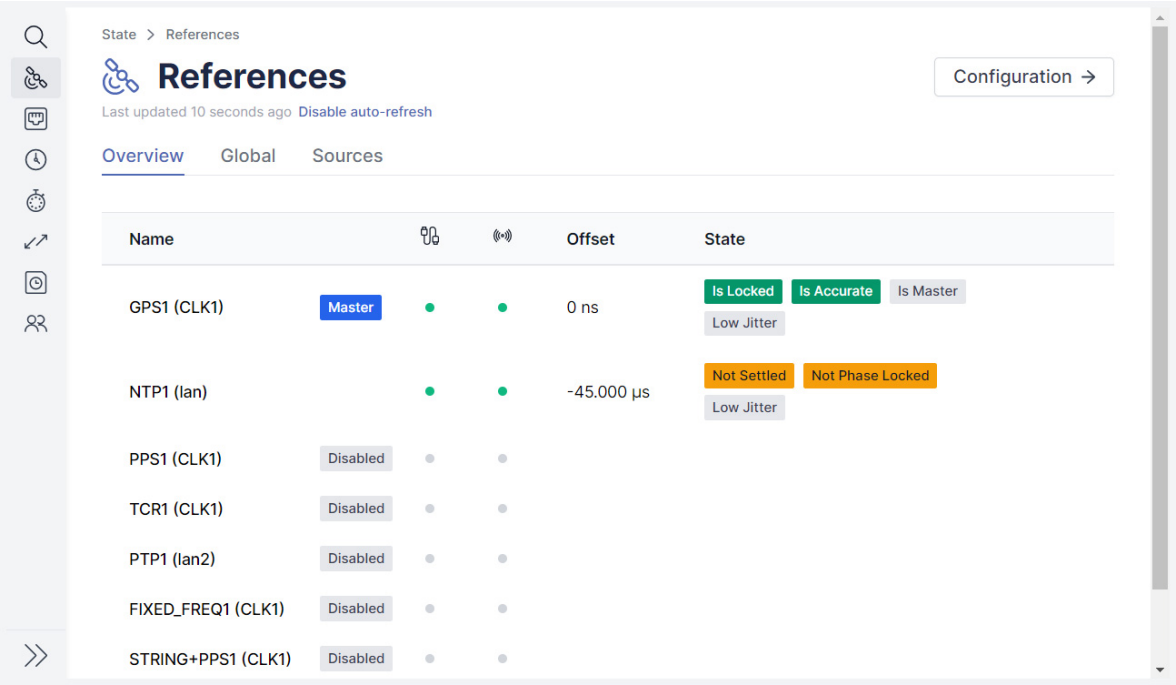

Figure 7.2: meinbergOS Web Interface: "State → References → Overview" Tab

The "**State** → **References** → **Overview**" tab (Fig. 7.2) provides a summary of your clock references and their synchronization status.

Name

The designation of the clock source. The interface connector is shown in parentheses:

CLK1: Signal transmitted through internal reference clock.
(e.g., GPS antenna, PPS, time string)

lan: NTP data communication over any configured Ethernet interface.

lan2: PTP data communication over the input-enabled PTP interface.

Information:

As of Version *2022.05.1*, *lan2* is the only input-enabled PTP interface and is therefore the only interface that can be operated as a PTP slave.

The reference source that is currently being used to adjust the clock is designated by a blue *Master* tag. Clock sources that have a gray *Disabled* tag appended to them have been explicitly disabled in the "**Configuration** → **References**" subsection.

Connection Detected

Green: Indicates that a wired connection is established with the signal source.

Red: Indicates that no wired connection is established to the signal source, or that the connection is faulty (e.g., coaxial cable from time server to antenna may be defective).

Signal Available

Green: Indicates that a viable signal has been detected over the connected cable.

Red: Indicates that no viable signal can be detected over the connected cable.

Offset

Reports the difference between the local system clock and the clock signal.

State

This column may show any number of tags indicating the status of the clock and its signal:

Is Locked: The clock is locked with the external reference signal and is using it to adjust the oscillator.

Is Accurate: The external clock signal is judged to be accurate (i.e., the minimum required accuracy of the oscillator has been reached).

Is Master: This reference source is currently being used to adjust the clock.

Is External: This reference source has been connected externally.

Low Jitter: The system has detected minimal jitter in the external clock signal, so that the accuracy of the reference source is acceptable.

Not Settled: The internal oscillator is not (yet) frequency-locked with the external clock signal.

Not Phase Locked: The internal oscillator is not (yet) phase-locked with the external clock signal.

No Connection: No wired connection with the signal source is detected.

No Signal: A wired connection with the signal source has been detected, but there is no viable signal detected over this cable.

Num. Sources Exceeded: The maximum limit for the number of allowed time sources has been exceeded.

ITU Limit Violated: The input source is of poor stability such that it is not in compliance with a specified ITU-T mask (e.g. PRC or SSU-A).

TRS Limit Violated: The time error limit for the Trusted Reference Source feature has been exceeded.

MTTF Limit Violated: This indicates that the reference exceeds the defined maximum offset ("Maximum Time to Follow") relative to the current reference and will therefore not be used in the event that the system falls back to Holdover Mode.

7.1.2 State - References - Global

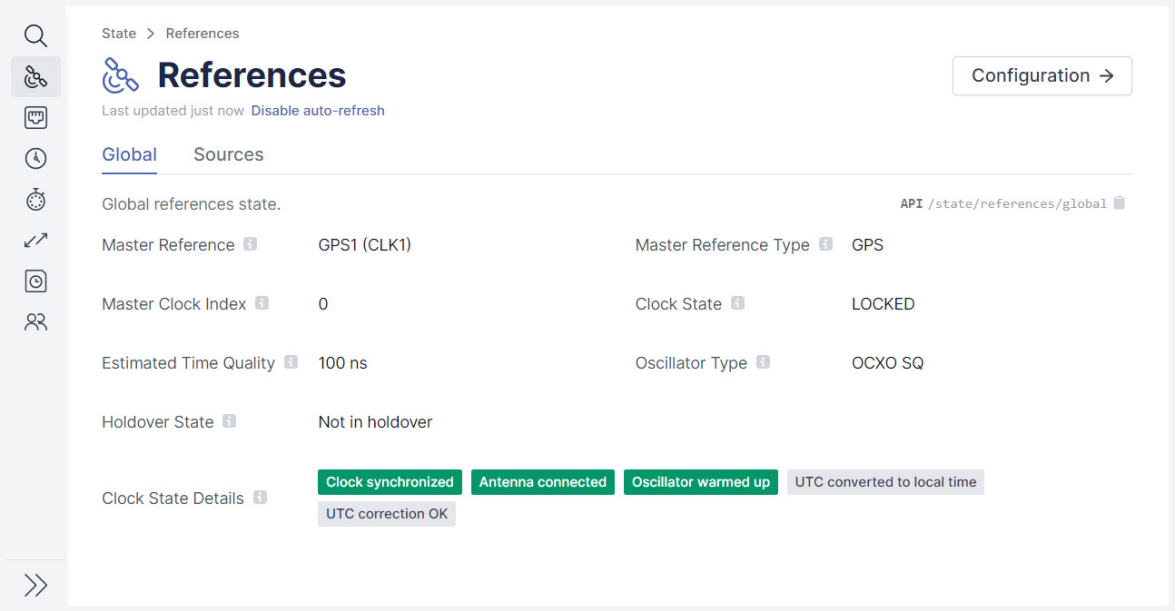

Figure 7.3: meinbergOS Web Interface: "State → References → Global" Tab

The "**State** → **References** → **Global**" tab (Fig. 7.3) provides a summary of your general clock status.

Master Reference: Indicates the source of the external master clock signal. The information in parentheses is the interface through which this clock signal is being passed.

Master Clock Index: The index number of the currently selected master clock. In meinbergOS systems without clock redundancy, this value will always be *0*.

Estimated Time Quality: An estimate of the quality of the system time relative to the external clock source.

Holdover State: Indicates whether the system is in **Holdover Mode**. Holdover Mode is defined as the state where the system is temporarily without an external clock synchronization source, meaning that the system is effectively de-synchronized, but the system is attempting to re-synchronize. In Holdover Mode, the system will attempt to maintain accurate time using the internal oscillator until it can be resynchronized.

Master Reference Type: The type of external signal received by the master clock interface.

Clock State: The synchronization and communication status of the master clock.

Oscillator Type: The type of oscillator installed inside your meinbergOS device (e.g., *OCXO SQ*, *OCXO HQ*).

Clock State Details

This provides detailed information on the status of the master clock.

Time Not Verified:	While the clock is synchronized with this reference source, meinbergOS is not using the time from it as the trustworthiness of it is in question.
Clock Synchronized:	The clock is synchronized with the reference signal.
Clock Not Synchronized:	The clock is not (yet) synchronized with any reference signal; accordingly, the clock time is not deemed to be correct.
Antenna Connected:	There is a functioning wired connection between the microSync system and the antenna used to receive the signal.
Antenna Short Circuit:	The receiver has detected a short circuit in the antenna connection.
Antenna Disconnected:	The antenna has been disconnected from the receiver or is not drawing any power.
Position Not Verified:	The GNSS receiver has not (yet) been able to calculate its position.
Oscillator Warmed Up:	The oscillator has reached its target frequency and is phase-locked with the reference PPS and 10 MHz signals.
Oscillator Not Warmed Up:	The oscillator is not yet aligned with the phase and frequency of its reference signal.
UTC Converted to Local Time:	The UTC time obtained from the reference signal is converted to the local time.
UTC Correction OK:	The current UTC adjustment parameters (including current leap second data) isdeemed valid.
Daylight Saving Change Announced:	A change in Daylight Saving Time has been announced at least one hour before the change is due to come into effect.
Daylight Saving In Effect:	The current local time includes the offset for Daylight Saving Time.
Leap Second Announced:	A leap second has been announced at least 12 hours before it is due to take effect.
Leap Second is Inserted:	The current second is a leap second (second 60 added to a minute).
Leap Second is Negative:	The current leap second insertion is negative (second 59 of a minute suppressed).
Invalid Time:	The clock time has not yet been initialized since startup.
Synchronized Externally:	The clock time has been set by external source.
Holdover Mode:	The clock is temporarily running off its internal oscillator as all of the previously used input source signals have been lost.

7.1.3 State - References - Sources

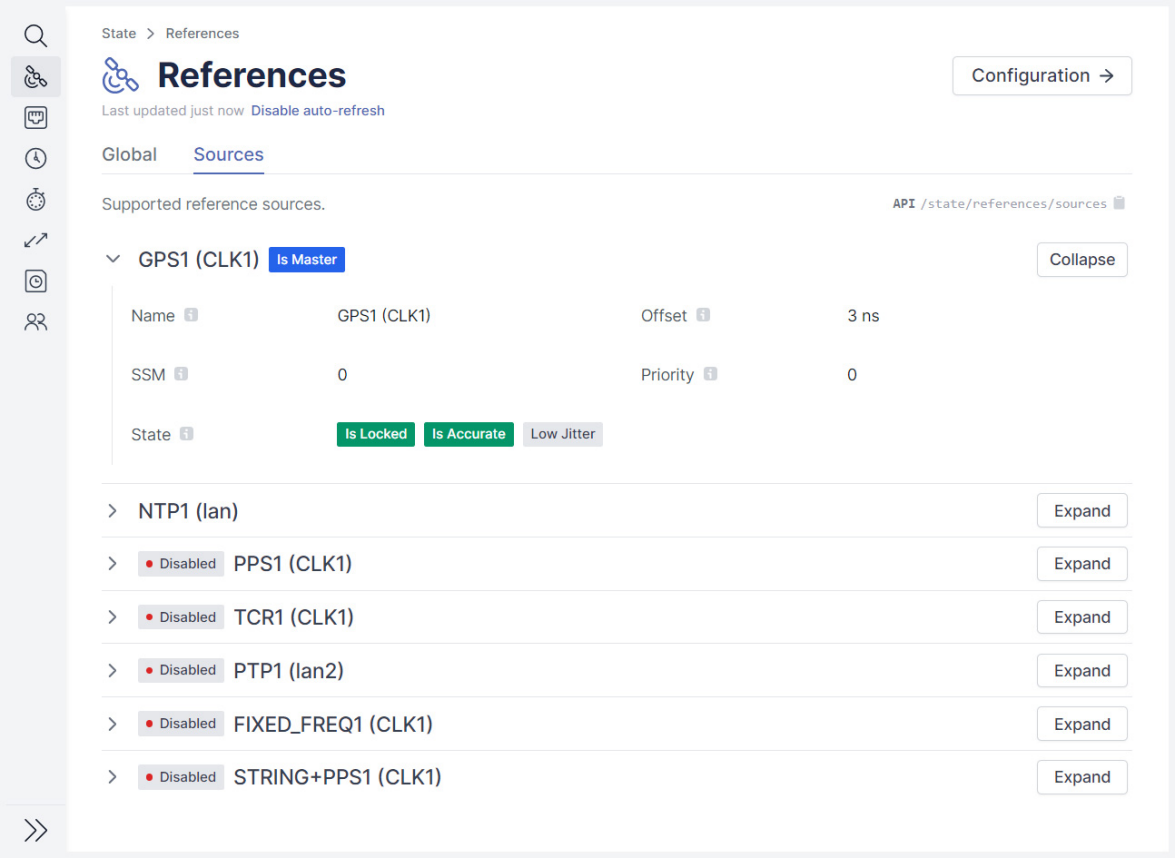

Figure 7.4: meinbergOS Web Interface: "State → References → Sources" Tab

The "**State** → **References** → **Sources**" tab (Fig. 7.4) provides more detailed information on each of the reference sources. Click on the panel of a specific reference to expand it and display the information. Click on the name or arrow again to collapse the panel and hide the information.

Name:	The reference source name and interface through which it is provided.
Offset:	Difference in time between the time source and the main reference.
SSM:	**Synchronization Status Message**. Specifies the quality of the time source and is relevant for SyncE.
Priority:	Priority of the source as defined under "**Configuration** → **References** → **Sources**".
Mean Offset (PPS/PTP/Fixed Freq. only):	The mean offset calculated during the previous statistical polling interval.
Standard Deviation (PPS/PTP/Fixed Freq. only):	The standard deviation of the offset values calculated during the previous statistical polling interval.
Current Record Timestamp: (PPS/PTP/Fixed Freq. only):	The timestamp of the most recent statistical record.
Span: (PPS/PTP/Fixed Freq. only):	The difference between the minimum and maximum offset values recorded during the last statistical interval.
Step Compensated: (PPS/PTP/Fixed Freq. only):	Specifies whether a time jump has been compensated for at the input source.
State:	A series of tags illustrating the status of the source. See chapter "**State - References - Overview**" for more details.
Additional Info:	Provides additional information about the source as supported (such as IP address).

7.2 State - Network

The "**State** → **Network**" subsection provides general information about your network connectivity, including PRP network path redundancy and network bonding.

Main: This tab shows the main general network configuration parameters, notably the hostname, default gateways, and DNS servers.

Interfaces: This tab provides information on the physical network interfaces and associated virtual interfaces. It also provides options for Synchronous Ethernet (SyncE) and the **Network** LED on the device itself.

PRP: The **PRP** (Parallel Redundancy Protocol) tab provides information on the physical network interfaces connected for a PRP implementation.

Bonding: The bonding tab shows which physical interfaces are used for link aggregation, and also provides information on the bonding mode used.

7.2.1 State - Network - Main

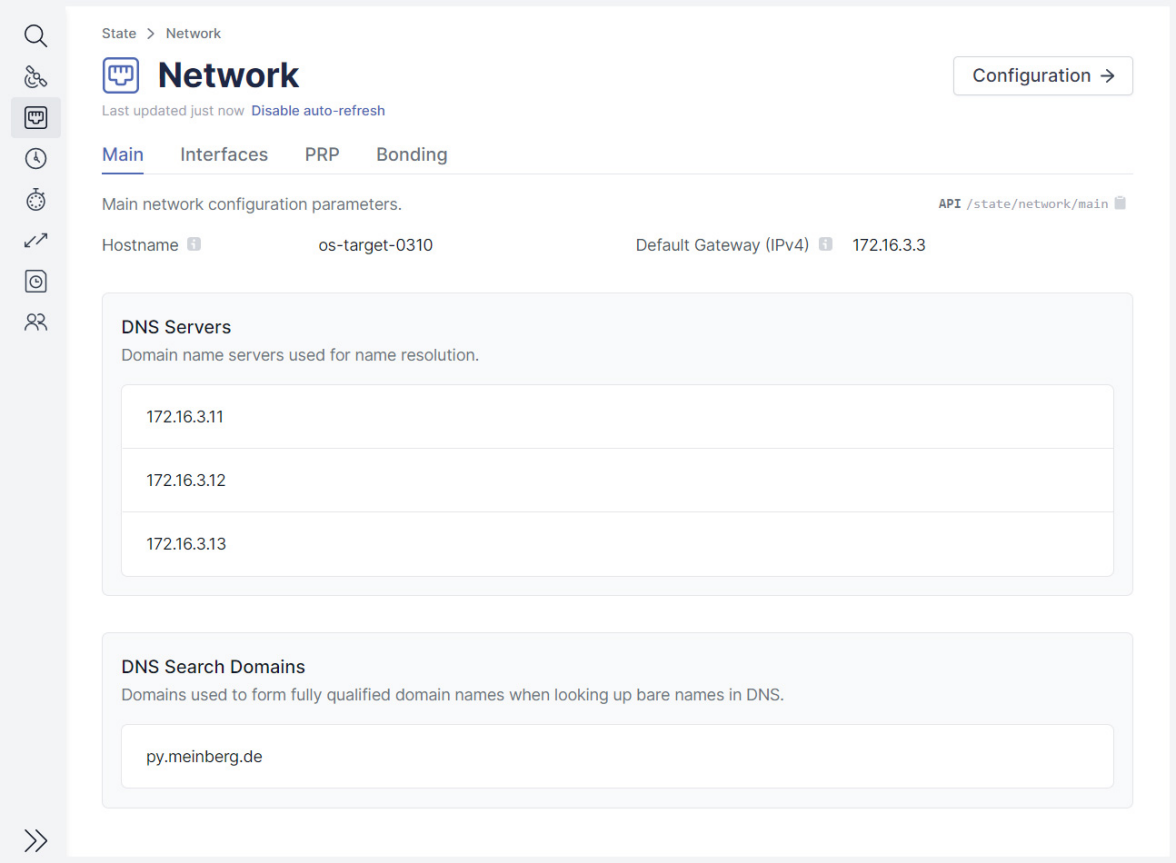

Figure 7.5: meinbergOS Web Interface: "State → Network → Main" Tab

The "**State** → **Network** → **Main**" tab (Fig. 7.5) provides a summary of your primary network configuration.

Hostname: The current hostname of the meinbergOS device, as defined under "**Configuration** → **Network** → **Main**".

Default Gateway (IPv4): The IPv4 address of the default network gateway.

Default Gateway (IPv6): The IPv6 address of the default network gateway, provided that IPv6 is configured. If IPv6 is not configured, this field will show *n/a*.

DNS Servers: Shows the DNS servers used for domain name resolution.

DNS Search Domains: The domains to be appended to bare (unqualified) hostnames for DNS queries.

7.2.2 State - Network - Interfaces

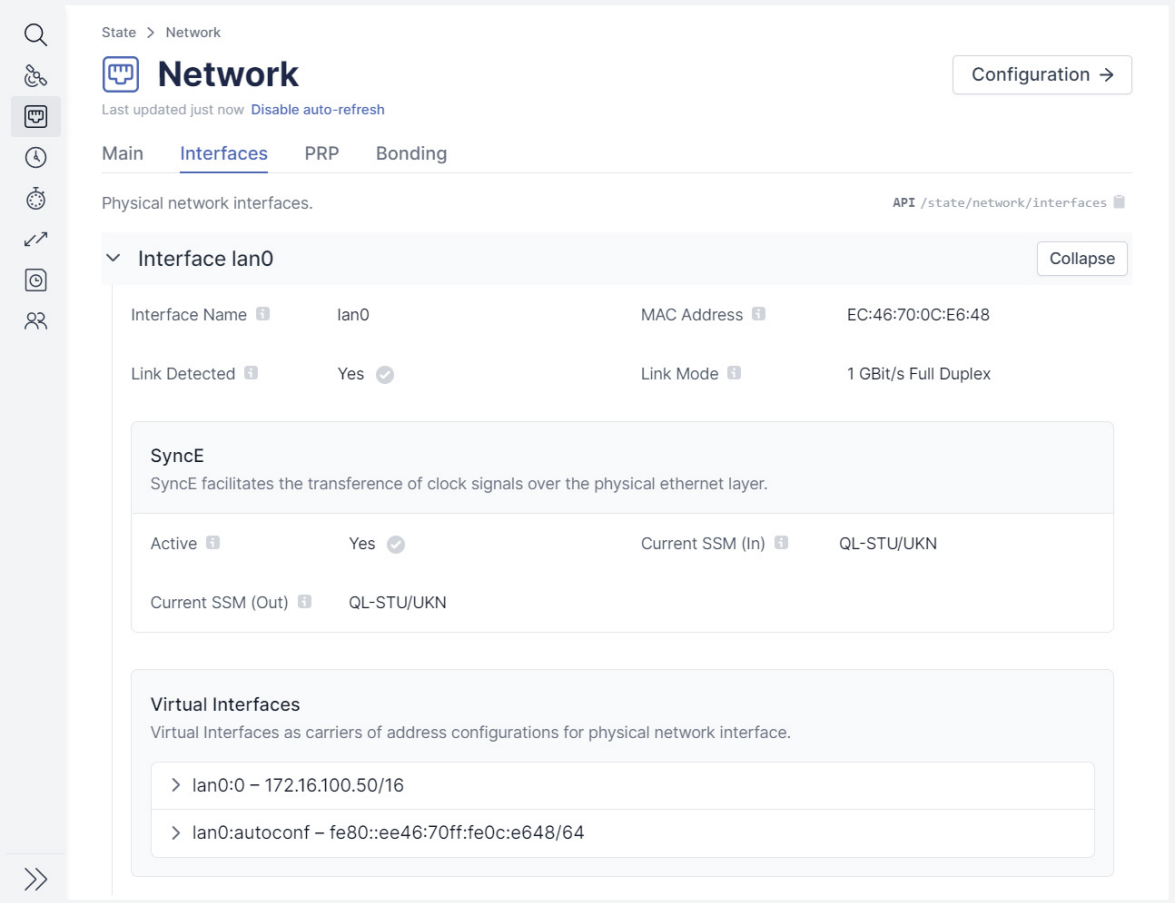

Figure 7.6: meinbergOS Web Interface: "State → Network → Interfaces" Tab

The "**State → Network → Interfaces**" tab (Fig. 7.6) provides details of the status of each individual Ethernet interface in your meinbergOS device. Each interface panel can be opened and closed by selecting it.

Interface Name: The internal system designation for the Ethernet interface.

MAC Address: Indicates the MAC address for the network interface controller (NIC) managing that Ethernet interface. If two Ethernet interfaces are bound to a PRP interface, the MAC address for those two Ethernet interfaces will be identical.

Link Detected: Indicates whether a physical Ethernet connection has been detected ("link-up").

Link Mode: Specifies the link speed and duplex mode of the Ethernet connection. This may have been autonegotiated or manually set under "Configuration".

SyncE: Specifies whether Synchronous Ethernet has been enabled for this Ethernet interface, and if so, the current **Quality Level** in *Master* (output) and *Slave* (input) mode. Refer to "SSM Quality Levels" for further information.

PRP Master: If PRP is enabled for this interface, this indicates the PRP interface that this Ethernet interface is currently bound to. For a functional PRP implementation, two of the Ethernet interfaces listed here must have the same PRP master.

PRP Path: If PRP is enabled for this interface, this specifies which of the two paths in the PRP configuration this Ethernet interface is used for.

Virtual Interfaces: The virtual interfaces configured for this physical interface are displayed in this panel, showing the interface name, DHCP state, set or assigned IP address, and prefix bits for the netmask.

7.2.3 State - Network - PRP

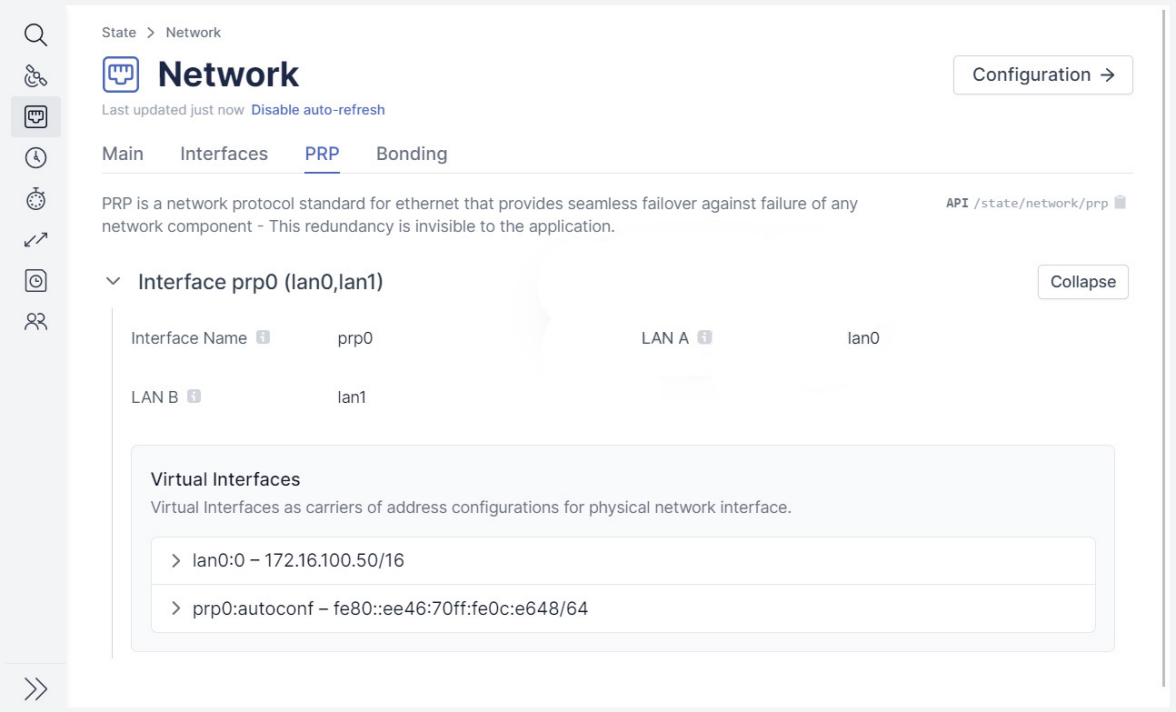

Figure 7.7: meinbergOS Web Interface: "State → Network → PRP" Tab

The "**State** → **Network** → **PRP**" tab (Fig. 7.7) provides details for configured PRP interfaces. PRP is a network protocol standard for Ethernet that enables seamless network path failover in the event of failure of any network components.

Interface Name: The internal system designation for the PRP interface.

LAN A: The physical Ethernet interface that serves as the first PRP path, as configured under "**Configuration** → **Network** → **PRP**".

LAN B: The physical Ethernet interface that serves as the second PRP path, as configured under "**Configuration** → **Network** → **PRP**".

Each PRP interface panel also features a sub-panel showing the virtual interfaces assigned to that PRP interface. Refer to the chapters "**Configuration - Network - Interfaces**" and "**State - Network - Interfaces**" for more information.

7.2.4 State - Network - Bonding

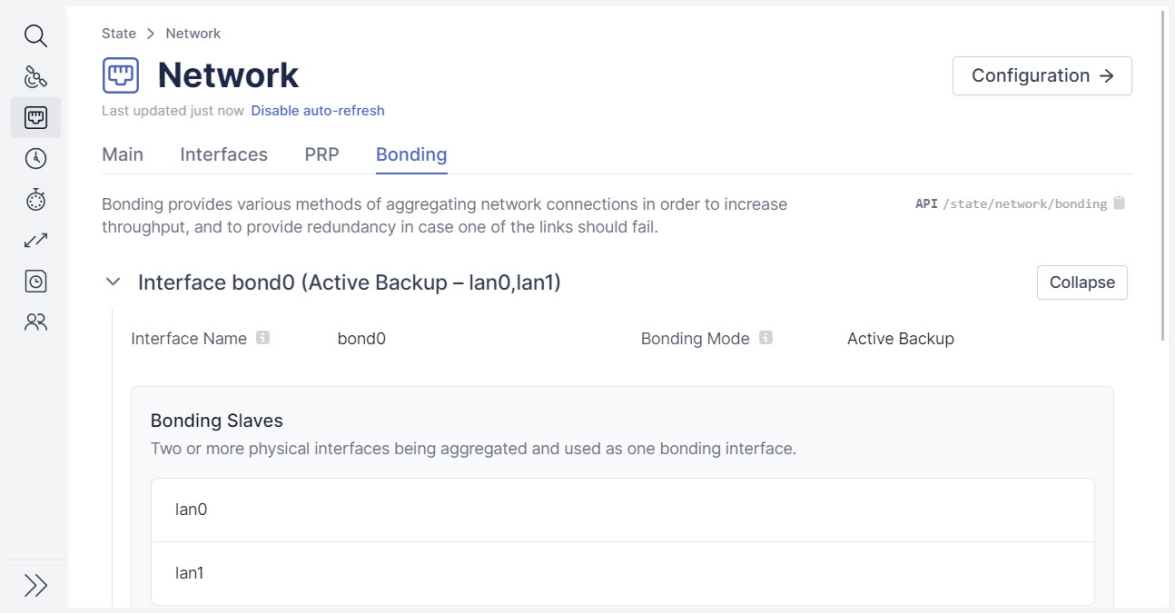

Figure 7.8: meinbergOS Web Interface: "State → Network → Bonding" Tab

The "**State** → **Network** → **Bonding**" tab (Fig. 7.8) provides information on aggregated ('bonded') network connections. Bonded network connections are used to increase throughput and provide redundancy by various means in case one of the links fails.

Interface Name: The internal system designation assigned by the Kernel for the bonding interface.

Bonding Mode: The mode set for the Linux bonding driver (network interface aggregation mode). This is the mode defined under **Configuration**, and may be "*Round Robin*", "*Active Backup*", "*XOR*", "*Broadcast*", or "*802.3ad (LACP)*".

Bonding Slaves: The slave interfaces in the bonding group are listed here.

Virtual Interfaces: The virtual interfaces assigned to this bonding group.

7.3 State - NTP

The "**State** → **NTP**" subsection provides general information about the system's NTP functionality, both as a server and as a client.

Main: This tab provides general information about the meinbergOS device's own NTP service.

Server: This tab provides information about the local NTP server as used to serve external clients.

Client: This tab provides information about remote NTP servers serving this meinbergOS device.

7.3.1 State - NTP - Main

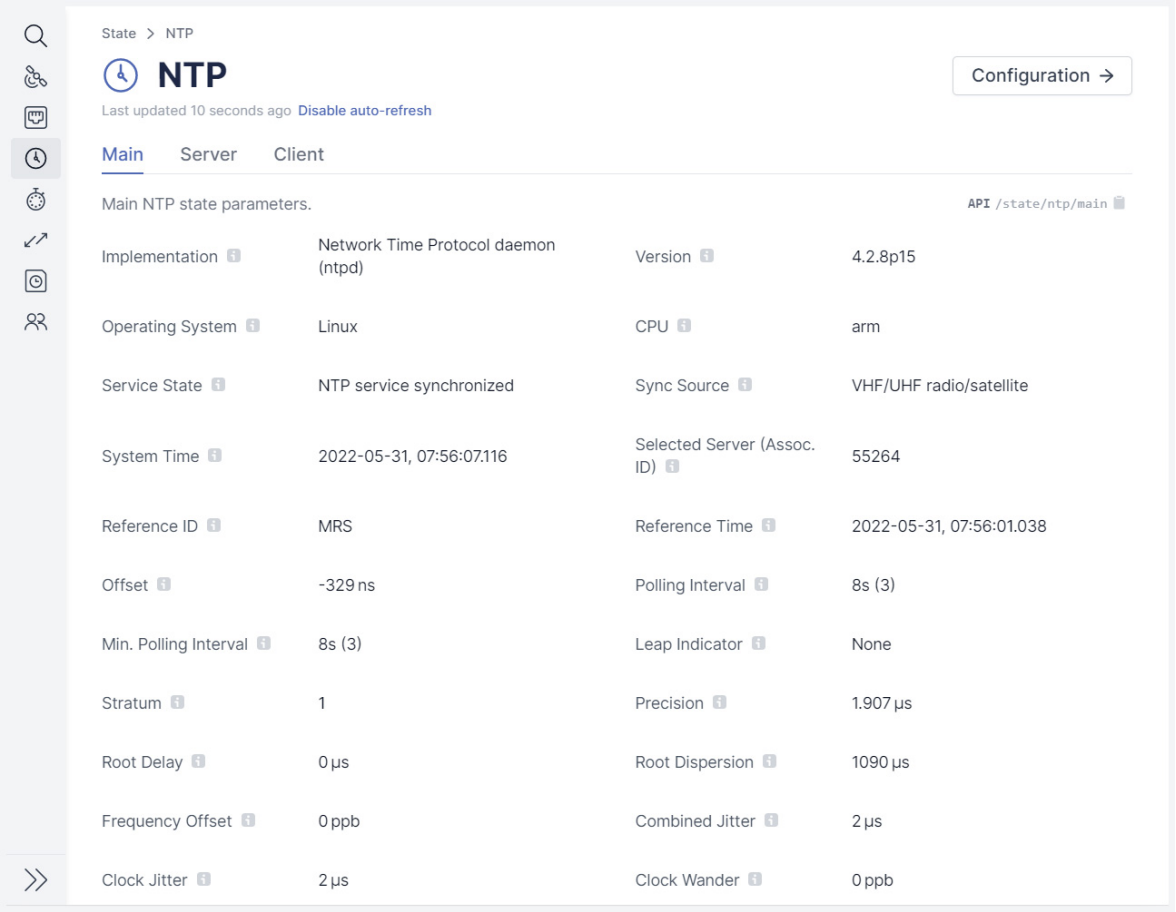

Figure 7.9: meinbergOS Web Interface: "State → NTP → Main" Tab

The "**State → NTP → Main**" tab (Fig. 7.9) provides general information about the meinbergOS device's own NTP service.

Implementation: The NTP implementation being used by the system. This should always read "*Network Time Protocol daemon (ntpd)*".

Version: The version of the NTP implementation of the system. This version number relates to the version numbering system employed by the official NTP Project.

Operating System: The operating system used for your system. This should always read "*Linux*".

CPU: The type of CPU used in the device. For most systems, this will usually be "*arm*".

Service State: The current synchronization status of the NTP service. This can be:

- *NTP service initializing*
- *NTP service synchronized*
- *NTP service not synchronized*
- *NTP service stopped*

Sync Source: The "source" of the signal used to synchronize the system. This will usually read "*VHF/UHF radio/satellite*" due to how the NTP service operates within the meinbergOS device. The actual reference source for the NTP service can be identified under "**State** → **References**". Refer to chapter "**State - References**" for further information.

System Time: The current system time as at the time this page was last loaded.

Selected Server (Assoc. ID): The association ID of the current system peer. This references a relationship (association) between an NTP server and NTP client.

Reference ID: The reference ID of the current NTP system peer. This will usually be "*MRS*", which refers to the internal clock module of meinbergOS devices.

Reference Time: The last time the system time was adjusted.

Offset: The cumulative offset relative to the current system peer.

Polling Interval: The current polling interval for NTP system peers. This is the value currently applied by this system for querying the selected system peer.

Min. Polling Interval: The minimum polling interval for system peers.

Leap Indicator: The latest leap indicator announcement, if provided by the NTP service. The leap indicator may specify if a leap second is to be inserted ("*Insert second*") or removed ("*Delete second*"), or if leap indicators cannot be acquired due to loss of synchronization ("*Alarm*").

Stratum: The current stratum level of the system. A clock that is synchronized directly against a Stratum 0 clock such as a GPS signal is a Stratum 1 clock; therefore, provided that your system has a stable Stratum 0 lock, this value should be *1*.

If the system becomes desynchronized, the NTP service will enter "orphan mode", and the corresponding stratum level defined under "**Configuration** → **NTP** → **Server**" will be displayed here.

Precision: The current accuracy of the system clock.

Root Delay: The total estimated round trip delay (time to transmit messages to current system peer plus time to receive acknowledgement of receipt).

Root Dispersion: The additional dispersion time in communication with the system peer, representing delays caused by other factors such as clock frequency inaccuracy.

Frequency Offset: The current frequency offset relative to the hardware clock. This value is calculated automatically to account for possible drift in the hardware clock.

Combined Jitter: The total combined jitter of the system. This value corresponds to the *ntpq* value *sys_jitter*.

Clock Jitter: The current jitter of the clock. Clock jitter refers to phase deviations in the actual clock waveform edge positions relative to the expected waveform edge positions.

Clock Wander: The frequency wander of the clock. Clock wander refers to long-term frequency variations in the clock, is measured in parts per billion (ppb) and is an indicator of overall system clock stability. It corresponds to the *ntpq* value *clk_wander*.

7.3.2 State - NTP - Server

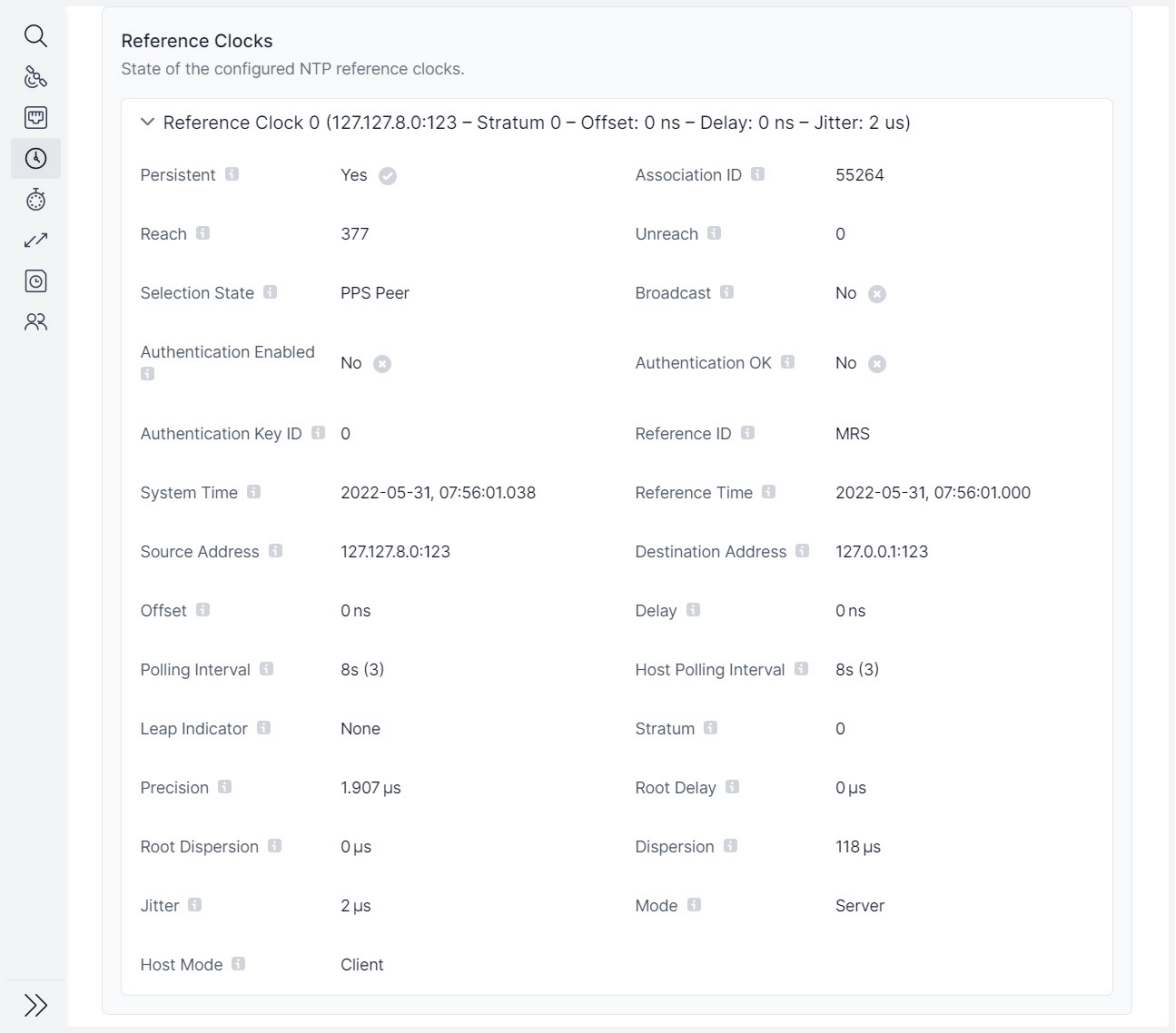

Figure 7.10: meinbergOS Web Interface: "State → NTP → Server" Tab

Information:

This information relates to how your meinbergOS device operates as an NTP server or peer and not to your meinbergOS device as a client.

For information on NTP server/client relationships where your meinbergOS device is the client, please open the subsection "**State → NTP → Client**" and refer to the information provided in the corresponding chapter of this manual.

Reference Clocks

State of the configured NTP reference clocks.

Persistent: If this source is configured as a persistent server (i.e., not accessed as part of a pool server), this entry will show *Yes*.

Association ID: The unique association ID for this source assigned by NTP.

Reach: This is a reachability shift register for the last eight polling intervals, expressed as a three-digit octal value. This octal value can be used to easily derive each individual bit of the 8-bit shift register by converting each digit to its corresponding binary value.

It should always be "*377*" in this case, as the local NTP client is polling the local NTP server. Any other value may be indicative of an internal system error.

Unreach: The total number of unsuccessful polling intervals since last (re)boot or since the last restart of the NTP daemon. This should generally be *0*. Any other value may be indicative of an internal system error.

Selection State: The current peer selection status of the source.

Broadcast: Indicates if the peer association with this source is a broadcast association.

Authentication Enabled: Indicates if authentication is enabled for this source.

Authentication OK: Indicates if authentication was successful for this source.

Authentication Key ID: This is the ID of the symmetric key being used for authentication.

Reference ID: The reference ID of this system as a source.

System Time: The current system time of this source as at the time this page was last loaded.

Reference Time: This shows when the time of this source was last adjusted.

Source Address: IP address and port of the local clock. This will generally read *127.127.8.0:123*, as this is the address of the NTP server as accessible from the NTP server itself and relates to the internal clock of the meinbergOS device.

Destination Address: IP address and port of the local system. This will generally read *127.0.0.1:123*, which is the address of the NTP client residing on the NTP server itself and relates to the internal clock of the meinbergOS device.

Offset: The filter offset between the reference clock and the current system time for this NTP source. This value should be *0* as long as the clock is synchronized.

Delay: The filter path delay between the reference clock and the current system time for this NTP source. This value should be *0* when using the meinbergOS device's internal clock module and the clock frequency is stable.

Polling Interval: The polling interval currently used internally by this source from the perspective of the local NTP server and applied to associations with external NTP clients and peers.

Host Polling Interval: The polling interval currently used internally by this source from the perspective of the local NTP client. This will be identical to the host polling interval, which is the polling interval used internally by this source from the perspective of the local NTP server.

Leap Indicator: The latest leap indicator announcement of this source. The leap indicator may specify if a leap second is to be *inserted* or *removed*, or if leap indicators cannot be acquired due to loss of synchronization ("*Alarm*").

Stratum: The current stratum level of this NTP server in relation to its own NTP client. This will always be a fictitious *0* and has no bearing on the actual stratum of the meinbergOS device in use as an NTP server.

Precision: The current accuracy of this source.

Root Delay: The total estimated round trip delay (time to transmit messages to current system peer of this source, plus time to receive acknowledgement of receipt). This should generally be *0*, as there is no round trip involved in the internal communication.

Root Dispersion: The additional dispersion time in communication with the system peers of this source, representing delays caused by other factors such as clock frequency inaccuracy. This should generally be *0*.

Dispersion: The filter dispersion for this source.

Jitter: The filter jitter for this source.

Mode: The NTP mode for this source. This will always be *Server*.

Host Mode: The NTP mode of the requesting host. This will always be *Client*.

7.3.3 State - NTP - Client

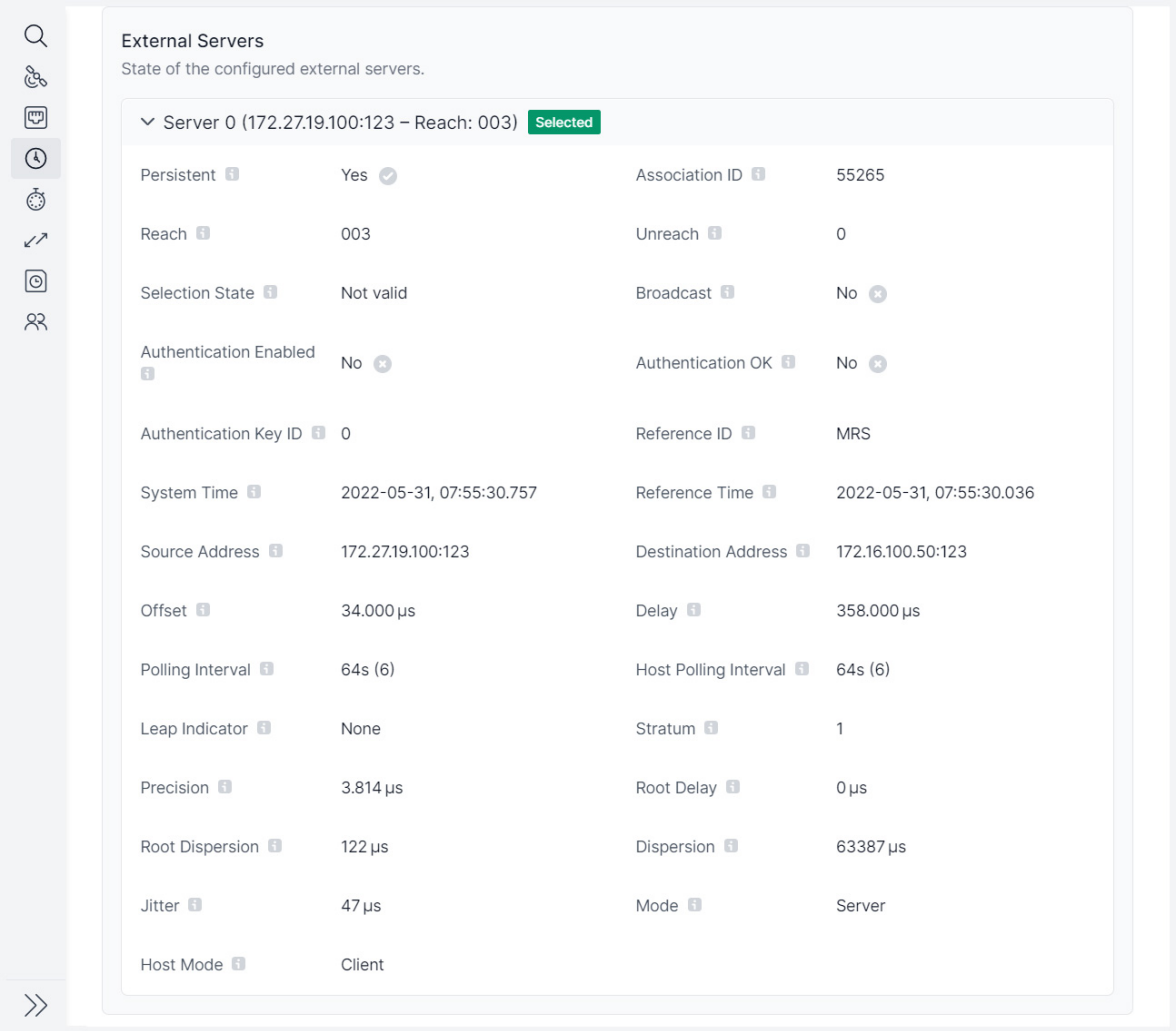

Figure 7.11: meinbergOS Web Interface: "State → NTP → Client" Tab

Information:

This information relates to how your meinbergOS device operates as an NTP client and not to clients that your meinbergOS device may be a server to.

For information on NTP server/client relationships where your meinbergOS device is the **server**, please open the subsection "**State → NTP → Server**" and refer to the guidance provided in the corresponding chapter of this manual.

External Servers

Shows the state of the external servers configured for the meinbergOS device's NTP client.

Persistent: If this source is configured as a persistent server (i.e., not accessed as part of a pool server), this entry will show *Yes*.

Association ID: The unique association ID for this source assigned by NTP.

Reach: This is a reachability shift register for the last eight polling intervals, expressed as a three-digit octal value. This octal value can be used to easily derive each individual bit of the 8-bit shift register by converting each digit to its corresponding binary value.

For example, a value of "*377*" indicates that all of the last eight polling intervals were successful, because *3 = 11* and *7 = 111*, making *377* equivalent to the binary value *11111111*.

Unreach: The total number of unsuccessful polling intervals since last (re)boot or since the last restart of the NTP daemon.

Selection State: The current peer selection status of the source.

Broadcast: Indicates if the peer association with this source is a broadcast association.

Authentication Enabled: Indicates if authentication is enabled for this source.

Authentication OK: Indicates if authentication was successful for this source.

Authentication Key ID: This is the ID of the symmetric key being used for authentication.

Reference ID: The reference ID of this source.

System Time: The current system time of this source as at the time this page was last loaded.

Reference Time: This shows when the time of this source was last adjusted.

Source Address: The IP address and port of this source (server or peer).

Destination Address: The IP address of this system's NTP client.

Offset: The filter offset for this NTP source.

Delay: The filter delay for this NTP source.

Polling Interval: The polling interval currently used by this peer or server.

Host Polling Interval: The polling interval currently used by the meinbergOS device.

Leap Indicator: The latest leap indicator announcement, if provided by the NTP service. The leap indicator may specify if a leap second is to be inserted ("*Insert second*") or removed ("*Delete second*"), or if leap indicators cannot be acquired due to loss of synchronization ("*Alarm*").

Stratum: The current stratum level of this NTP source. Servers directly synchronized with a Stratum 0 clock will be Stratum *1*. If an NTP server or peer is unable to reach any of its sources, it will generally be Stratum *16*.

Precision: The current accuracy of this source.

Root Delay: The total estimated round trip delay (time to transmit messages to current system peer of this source, plus time to receive acknowledgement of receipt).

Root Dispersion: The additional dispersion time in communication with the system peers of this source, representing delays caused by other factors such as clock frequency inaccuracy.

Dispersion: The filter dispersion for this source.

Jitter: The filter jitter for this source.

Mode: The NTP mode for this server.

Host Mode: The NTP mode for the meinbergOS device in respect of its association with the server or peer.

7.4 State - PTP

The "**State** → **PTP**" subsection provides general information about the system's PTP functionality, both as a master and a slave. It also provides two tabs—**Interfaces**, which provides information on the PTP-related states of the PTP-enabled virtual interfaces, and **Instances**, which provides information on the configured PTP instances and comprehensive readouts of the relevant datasets.

The panels at the top of the Content Area provides an overview of the PTP service at each assigned virtual interface. The header shows the name set under "**Configuration** → **PTP** → **Instances**", the virtual interface, and the EUI-64 clock identifier.

Network Interface: Indicates the link state of the physical network interface.

Domain: The PTP domain set for this PTP instance.

GM Clock Class: An 8-bit value (*0–255*) specifying the class of the grandmaster. The **Clock Class** indicates the clock's suitability as a master clock (lower value = more suitable).

GM Clock Accuracy: The accuracy range of the grandmaster clock relative to UTC.

GM Clock Variance: A statistical value representing clock jitter and wander between two sync message intervals.

GM Clock Identity: The EUI-64 identifier of the grandmaster clock.

UTC Offset: The current UTC offset of this instance.

Offset from Master (Slave only): Specifies the current offset from the master clock.

Offset from Reference (Slave only): Specifies the current offset from the internal reference.

Path Delay (Slave only): Specifies the current mean path delay relative to the current master clock.

Time Properties

These are the time property flags that may be displayed in relation to the current PTP time:

Time is traceable: This specifies whether the master clock's time can be traced back to a primary reference other than itself.

Frequency is traceable: This specifies whether the master clock's frequency can be traced back to a primary reference other than itself.

UTC offset is valid: This specifies whether the master clock's UTC offset (or the instance's own UTC offset if the instance is itself in *Master* Mode) is valid.

Is PTP Timescale: This specifies whether the master clock is using the PTP timescale (TAI).

Leap 59 announced: This specifies that a negative leap second has been announced by the instance's reference source.

Leap 61 announced: This specifies that a positive leap second has been announced by the instance's reference source.

7.4.1 State - PTP - Interfaces

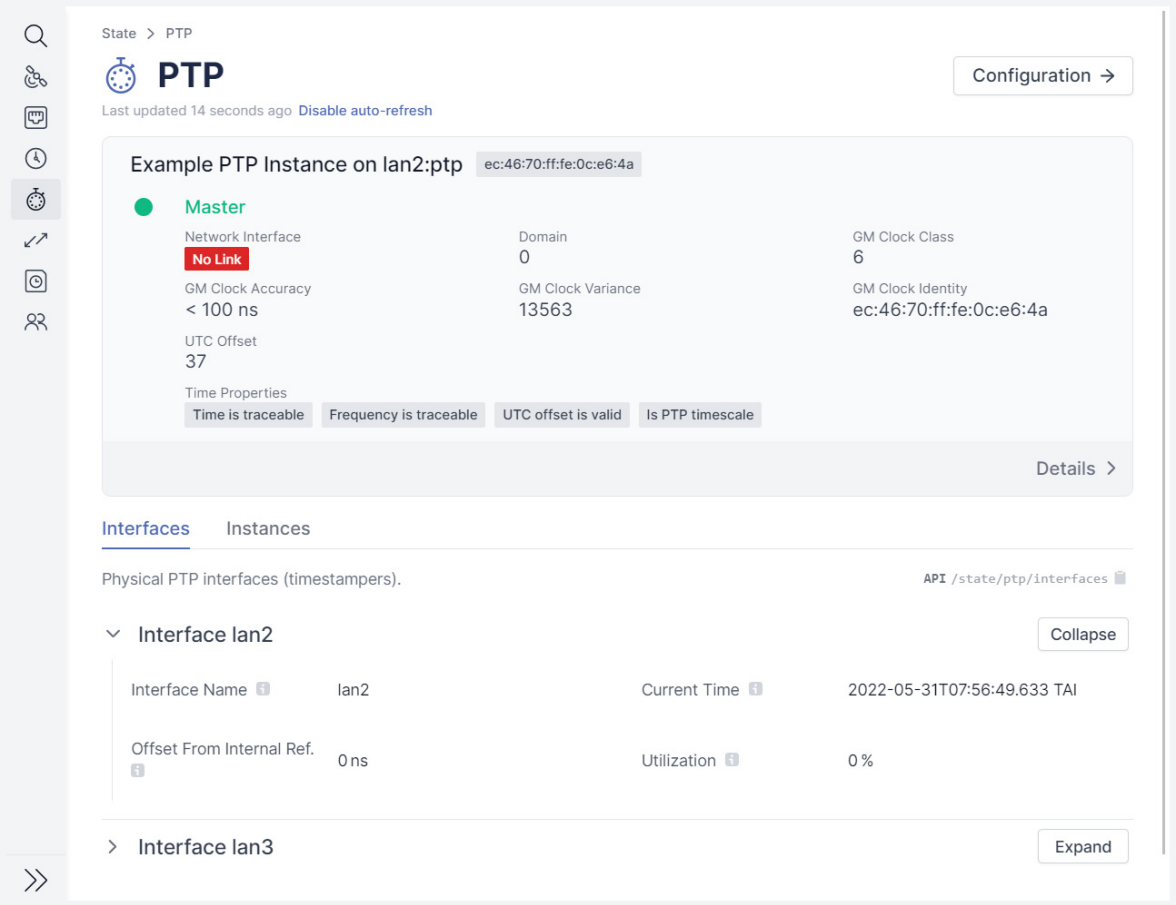

Figure 7.12: meinbergOS Web Interface: "State → PTP → Interfaces" Tab

The tab "**State → PTP → Interfaces**" (Fig. 7.12) provides information about the physical PTP interfaces (timestampers) supported by your meinbergOS device.

Interface Name: The name of the physical PTP interface of the meinbergOS device.

Current Time: The current time of the timestamper, formatted according to ISO 8601.

Offset From Internal Ref.: Current time offset between the timestamper time and the internal reference time.

Utilization: Current resource utilization (messages per second) of this timestamper in percent.

7.4.2 State - PTP - Instances

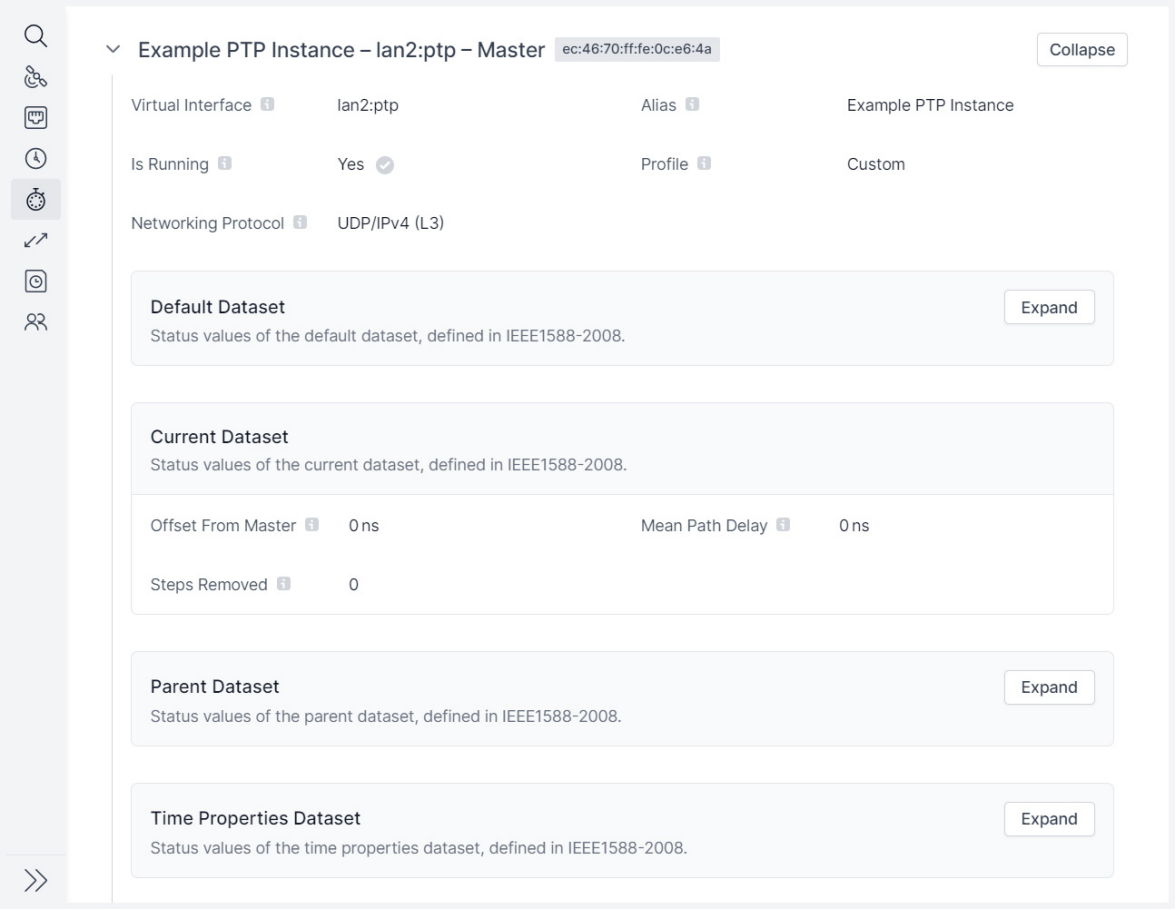

Figure 7.13: meinbergOS Web Interface: "State → PTP → Instances" Tab

The tab "**State** → **PTP** → **Instances**" (Fig. 7.13) provides information about the defined PTP instances.

Virtual Interface: The virtual interface (i.e., IP address) that the instance is using.

Alias: A manually assigned descriptive alias of this instance (if configured).

Is Running: Indicates whether the PTP stack of this instance is currently running.

Profile: The PTP profile that this instance is currently running in.

Networking Protocol: The networking protocol used by this instance. This may be *UDP/IPv4 (L3)*, *UDP/IPv6 (L3)*, or *IEEE 802.3 (L2)*.

Utilization: Current resource utilization (messages per second) in percent.

Default Dataset

These are the status values of the default dataset as defined in IEEE 1588-2008.

Number Ports: The number of PTP ports on the device.

Is Two-Step: Indicates whether the clock is a two-step clock (sync and timestamp are sent in two separate PTP messages). In end-to-end networks this should be *No*, as two-step clocks require predictable latency values with a singularly defined peer-to-peer connection.

Is Slave-Only: Indicates whether the clock is a slave-only clock.

Clock Class: The **Clock Class** attribute as defined by IEEE 1588-2008 or specific PTP profiles. It reflects the current synchronization state of the local clock. A lower class generally means a better master clock.

Clock Accuracy: One of the **Clock Accuracy** classes defined in IEEE 1588 reflecting the current accuracy of the local clock.

These classes are: *< 25 ns, < 100 ns, < 250 ns, < 1 us, < 2.5 us, < 10 us, < 25 us, < 100 us, < 250 us, < 1 ms, < 2.5 ms, < 10 ms, < 25 ms, < 100 ms, < 250 ms, < 1 s, < 10 s, more than 10 s*

Clock Variance: The **Offset-Scaled Log Variance** representing the time stability of the local clock. This value provides a basis of estimating the precision of the timestamping while not synchronized.

Priority 1: The **Priority 1** attribute of the local clock. This value dictates the absolute priority of the clock as a master candidate above any other operational factors.

Priority 2: The **Priority 2** attribute of the local clock. This value determines the priority of the clock as a master candidate, but is generally disregarded if the Best Master Clock can be other determined using **Clock Class**, **Clock Accuracy**, and **Clock Variance**. It is generally applied for backup or redundant master clocks.

Clock ID: The unique ID of the local clock. This is a 64-bit extended unique identifier ("EUI-64") that is normally based on the MAC address of the network device.

Domain Number: The PTP domain number of the local clock. The clock will ignore PTP messages with domain numbers other than this.

Current Dataset

These are the status values of the current dataset as defined in IEEE 1588-2008.

Offset From Master: The current difference between the master time and slave time.

Mean Path Delay: The current mean propagation time for messages between the master and slave.

Steps Removed: The number of hops between the local clock and the PTP grandmaster. If the local clock is connected directly to the grandmaster, this value will be *1*.

Parent Dataset

These are the status values of the parent dataset as defined in IEEE 1588-2008, relating to the parent of the local clock (the master clock most directly connected to the local clock).

Parent Clock ID: The clock ID of the master clock from which the local clock is currently directly receiving PTP messages. This is a 64-bit extended unique identifier ("EUI-64") that is normally based on the MAC address of the network device.

Parent Port ID: The port number of the master clock from which the local clock is currently directly receiving PTP messages.

Is Statistics Valid: Indicates whether the local clock has computed statistically valid estimates of the log variance and phase change rate of the parent clock.

GM Priority 1: The **Priority 1** attribute of the current grandmaster clock. This value dictates the absolute priority of the grandmaster as a master candidate above any other operational factors.

GM Priority 2: The **Priority 2** attribute of the current grandmaster clock. This value determines the priority of the clock as a master candidate, but is generally disregarded if the Best Master Clock can be other determined using **Clock Class**, **Clock Accuracy**, and **Clock Variance**. It is generally only applied for backup or redundant master clocks.

GM Clock Class: The **Clock Class** attribute for the grandmaster clock as defined by IEEE 1588-2008 or specific PTP profiles. It reflects the current synchronization state of the grandmaster clock.

GM Clock Accuracy: One of the **Clock Accuracy** classes defined in IEEE 1588 reflecting the current accuracy of the grandmaster clock.

GM Clock Variance: The **Offset-Scaled Log Variance** representing the time stability of the grandmaster clock. This value provides a basis of estimating the precision of the timestamping while not synchronized.

GM Clock ID: The **Clock ID** of the current grandmaster clock. This is a 64-bit extended unique identifier ("EUI-64") that is normally based on the MAC address of the network device.

Time Properties Dataset

These are the status values of the time properties dataset as defined in IEEE 1588-2008.

Is UTC Offset Valid: Specifies whether the current UTC offset is known to be valid.

Is Leap 61: If this is *Yes*, the last minute of the current UTC day will last 61 seconds (thus adding a leap second).

Is Leap 59: If this is *Yes*, the last minute of the current UTC day will last 59 seconds (thus removing a leap second).

Is PTP Timescale: If this is *Yes*, the timescale applies by the current grandmaster is the PTP timescale (International Atomic Time, TAI).

Is Time Traceable: If this is *Yes*, the timescale and UTC offset can be traced back to a primary reference.

Is Frequency Traceable: If this is *Yes*, the frequency determining the timescale can be traced back to a primary reference.

Time Source: The time source currently used by the grandmaster clock.

Port Dataset

These are the status values of the port dataset as defined in IEEE 1588-2008.

Clock ID: The clock ID of the local port. This is a 64-bit extended unique identifier ("EUI-64") that is normally based on the MAC address of the network device.

Port ID: The local port through which the local clock is currently communicating PTP messages.

Port State: The current state of the protocol engine currently associated with this port.

Announce The number of message intervals that has to pass without receipt of an **Announce**

Receipt Timeout: message before a network path or device is considered to possibly be failed.

Announce Interval: The mean time between individual **Announce** messages.

Sync Interval: The mean time between successive **Sync** messages when transmitted as multicast messages.

Delay Mechanism: The method used to calculate the propagation delay when computing the mean path propagation delay. This can be *P2P* (peer-to-peer) or *E2E* (end-to-end).

Version Number: The PTP version in use on this port.

Unicast Slaves

Unicast slaves connected to this meinbergOS device (serving as the PTP unicast master) are listed here.

Packet Counters

This list provides detailed packet counter statistics for all types of PTP messages, both incoming and outgoing.

Is Enabled: Specifies if packet counting is enabled for this PTP instance.

Announce Receipt Timeouts: This counts how many **Announce** receipt timeouts there have been so far.

Receive and Transmit Counters

The packet counters for incoming and outgoing packets respectively are explained below.

Total Messages: The total number of messages received/sent.

Total Messages Per Second: The number of messages currently being received/sent per second.

Announce Messages: The total number of **Announce** messages that have been received/sent.

Announce Messages Per Second: The number of **Announce** messages currently being received/sent per second.

Sync Messages: The total number of **Sync** messages that have been received/sent.

Sync Messages Per Second: The number of **Sync** messages currently being received/sent per second.

Follow Up Messages: The total number of **Follow-Up** messages that have been received/sent.

Follow Up Messages Per Second: The number of **Follow-Up** messages currently being received/sent per second.

Delay Request Messages: The total number of **Delay Request** messages that have been received/sent.

Delay Request Messages Per Second: The number of **Delay Request** messages currently being received/sent per second.

Delay Response Messages: The total number of **Delay Response** messages that have been received/sent.

Delay Response Messages Per Second: The number of **Delay Response** messages currently being received/sent per second.

Peer Delay Request Messages: The total number of **Peer Delay Request** messages that have been received/sent.

Peer Delay Request Messages Per Second:	The number of **Peer Delay Request** messages currently being received/sent per second.
Peer Delay Response Messages:	The total number of **Peer Delay Response** messages that have been received/sent.
Peer Delay Response Messages Per Second:	The number of **Peer Delay Response** messages currently being received/sent per second.
Peer Delay Response Follow Up Messages:	The total number of **Peer Delay Response Follow-Up** messages that have been received/sent.
Peer Delay Response Follow Up Messages Per Second:	The number of **Peer Delay Response Follow-Up** messages currently being received/sent per second.
Signaling Messages:	The total number of **Signaling** messages that have been received/sent.
Signaling Messages Per Second:	The number of **Signaling** messages currently being received/sent per second.
Management Messages:	The total number of **Management** messages that have been received/sent.
Management Messages Per Second:	The number of **Management** messages currently being received/sent per second.
Management Errors:	The total number of **Management** message errors.

7.5 State - IO Ports

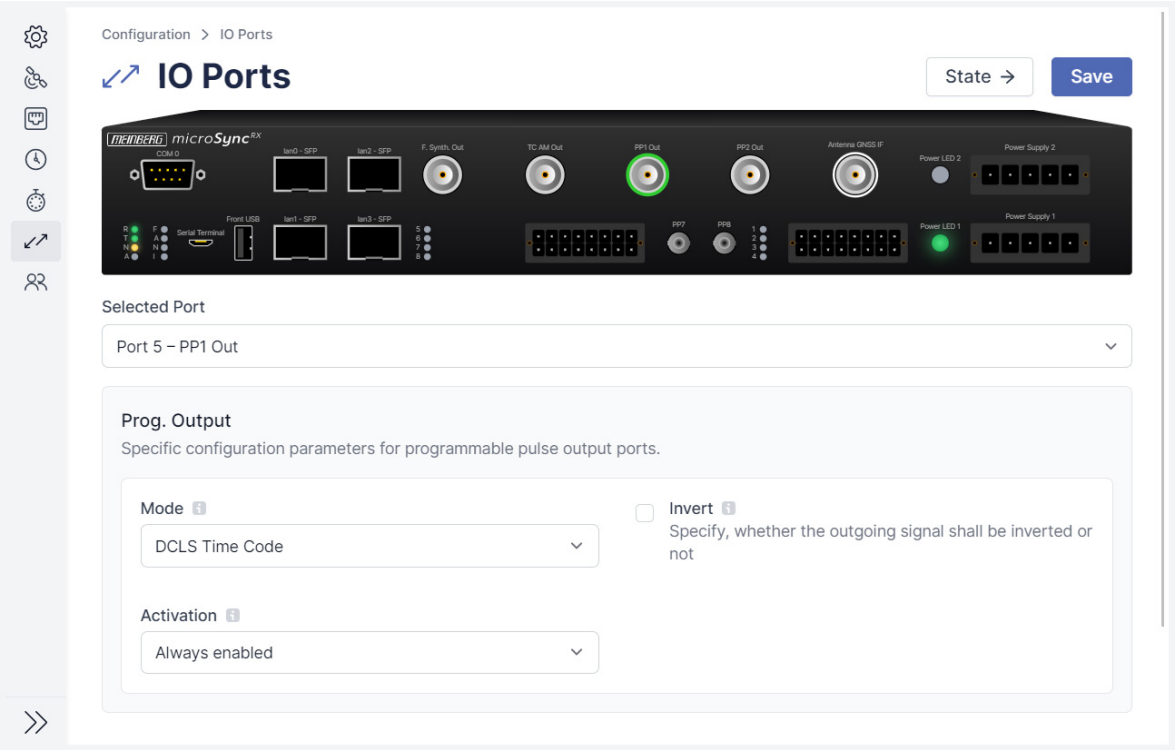

Figure 7.14: meinbergOS Web Interface: "State → IO Ports" Subsection

The "**State → IO Ports**" subsection (Fig. 7.14) provides a graphical representation of your physical meinbergOS device (for example, a microSync). Hovering with the mouse over any indicator or connector (or, in the case of multi-pin connectors, over an individual pin of a connector) will provide a brief explanation of the purpose of that component.

Clicking on a configurable connector or pin will open the corresponding configuration panel for that connector or indicator or provide a link to the relevant **Configuration** or **State** section.

Information:

Configuration options are not available for all I/O ports.

For more information, please refer to the chapter "**Configuration - IO Ports**".

7.6 State - Clock Module

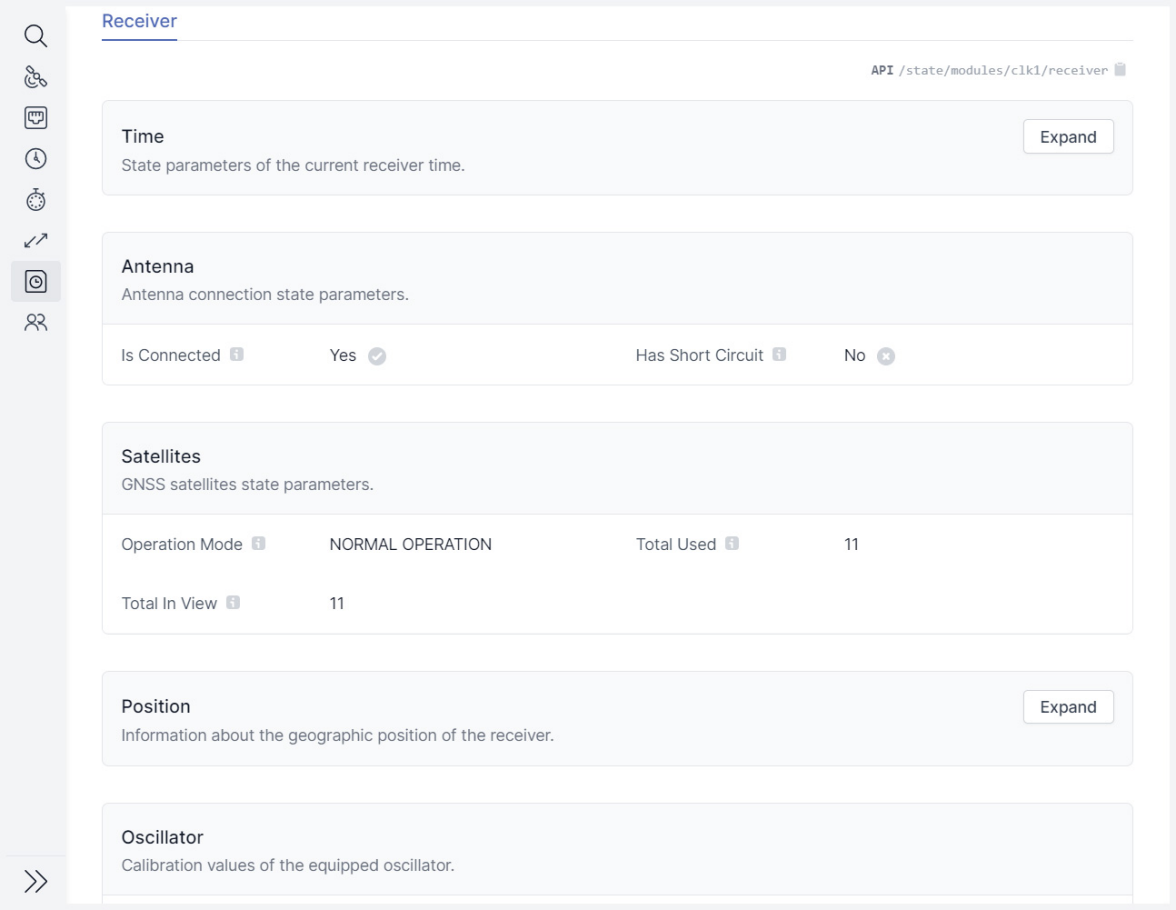

Figure 7.15: meinbergOS Web Interface: "State → Clock Module" Subsection

The **Clock Module** subsection provides information about the receiver integrated into the meinbergOS device.

Time

The **Time** panel provides status information regarding the time provided by the receiver.

Timestamp: The current time provided by the receiver.

UTC Offset: If the receiver is providing local time, this will show the current offset from UTC of the receiver's time.

Is Local Time: Indicates if the time provided by the receiver is the local time (not UTC).

Is Daylight Saving Time: This indicates if Daylight Saving Time is currently active, assuming that the receiver is providing local time. If the receiver is providing UTC time, this will of course show *No*.

Positive Leap Second Announced: This indicates if the upstream time source has provided the receiver with an announcement of an imminent positive leap second (61 seconds in last minute of day).

Negative Leap Second Announced: This indicates if the upstream time source has provided the receiver with an announcement of an imminent negative leap second (59 seconds in last minute of day).

GPS Week Number: This is the current GPS week number; this scale runs from the time the GPS system first entered service.

GPS Week Second: This is the current second in the current GPS week as of the last page refresh.

Antenna

The **Antenna** panel provides information on the connection between the clock module and the antenna.

Is Connected: Indicates if a connection with the antenna has been detected. Specifically, it establishes if a closed DC circuit is established with the antenna via the coaxial cable.

Has Short Circuit: Indicates if the clock module has detected a short circuit in the connection with the antenna (i.e., short from core to outer conductor of the coaxial cable).

Satellites

This **Satellites** panel provides information on the satellites found by the integrated GNSS receiver.

Operation Mode: This indicates the satellite lock status of the receiver. If this shows "*NORMAL OPERATION*", the receiver is locked into at least four satellites and is therefore able to establish its own geographical position. If this shows "*WARM BOOT*", it has not (yet) located enough satellites for geolocation, but is relying on existing almanac data to locate previously detected satellites. If "*COLD BOOT*" is displayed here, the receiver has not located enough satellites and does not have almanac data to refer to, which means that a GPS lock will take much longer to establish.

Total Used: This is the total number of satellites currently in use by the receiver for synchronization.

Total In View: This is the total of number of satellites currently detected by the receiver.

Position

The **Position** panel provides detailed information about detected geographical position of the antenna. The **Brief Information** shows the geographical coordinates in decimal degrees and the altitude above sea level in meters. The **Latitude** and **Longitude** panels can be expanded accordingly to obtain more precise geolocation information.

Oscillator

The **Oscillator** panel provides calibration information on the receiver's internal oscillator, specifically the coarse and fine calibration values of the digital-to-analog converter (DAC).

7.7 State - Users

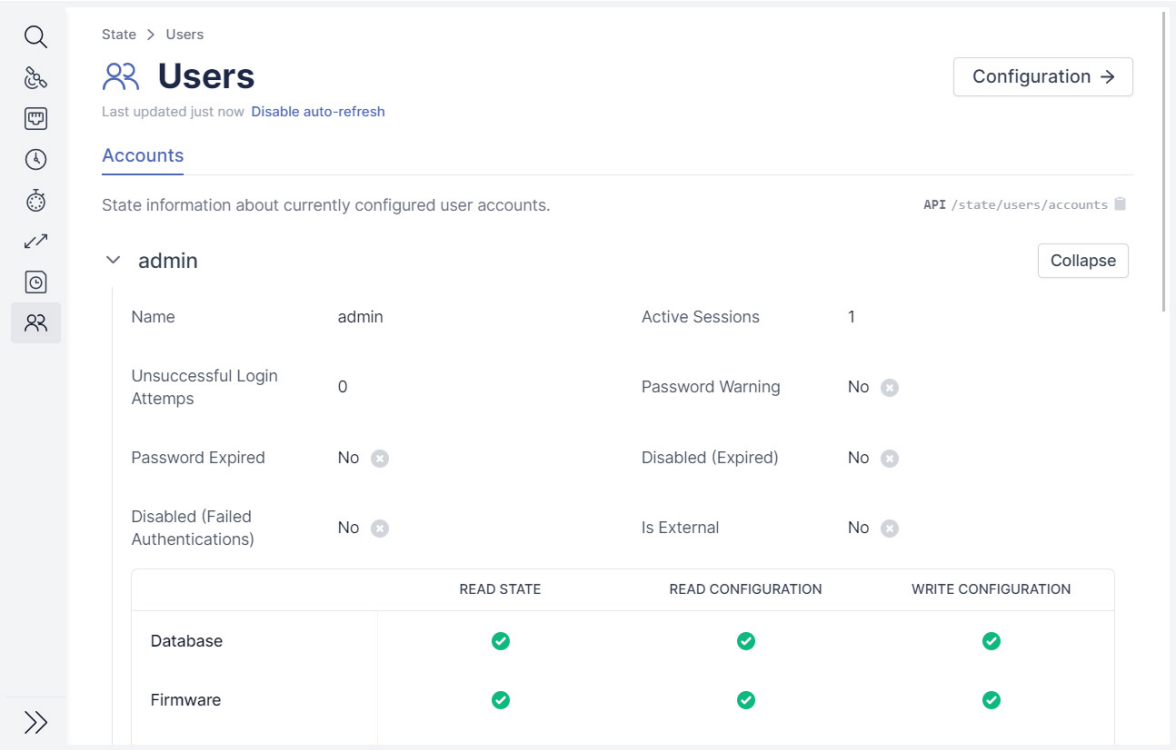

Figure 7.16: meinbergOS Web Interface: "State → Users" Subsection

The "**State → Users**" subsection (Fig. 7.16) provides a summary of all users currently configured on the system. Click on the user name or the "**Expand**" or "**Collapse**" buttons to expand or collapse the panel for that user account accordingly.

Name: The name used to log into the meinbergOS device.

Active Sessions: The number of sessions currently using the account as a login. If **Allow Multiple Sessions** is disabled under "**Configuration → Users**" this should never be more than *1*.

Unsuccessful Login Attempts: The number of failed attempts to log in using this account.

Password Warning: If *Yes*, a warning of the need to change the password has been issued.

Password Expired: If *Yes*, the password for this account has expired.

Disabled (Expired): This will show *Yes* if the account has been disabled due to the expiry of the password.

Disabled (Failed Authentications): This will show *Yes* if the account has been disabled due to the number of failed login attempts exceeding the defined limit.

Is External: If the meinbergOS device is only able/configured to use local user profile information, this will display *No*. If the meinbergOS device supports and is configured for an external directory service (such as LDAP), this will show *Yes*.

User Permissions

The permissions listed here show the permissions assigned to the user to view and/or modify various aspects of the meinbergOS device's configuration. **Read State** refers to the ability to view the corresponding status information in the **State** section. **Read Configuration** refers to the ability to view the corresponding configuration in the **Configuration** section. **Write Configuration** refers to the ability to view and modify the corresponding configuration subsection in the **Configuration** section.

Please note that to view this user status subsection in the first place, the user must be configured to have **Read State** access to **Users**.

Please refer to the chapter "**Configuration - Users**" for more information.

8 Maintenance

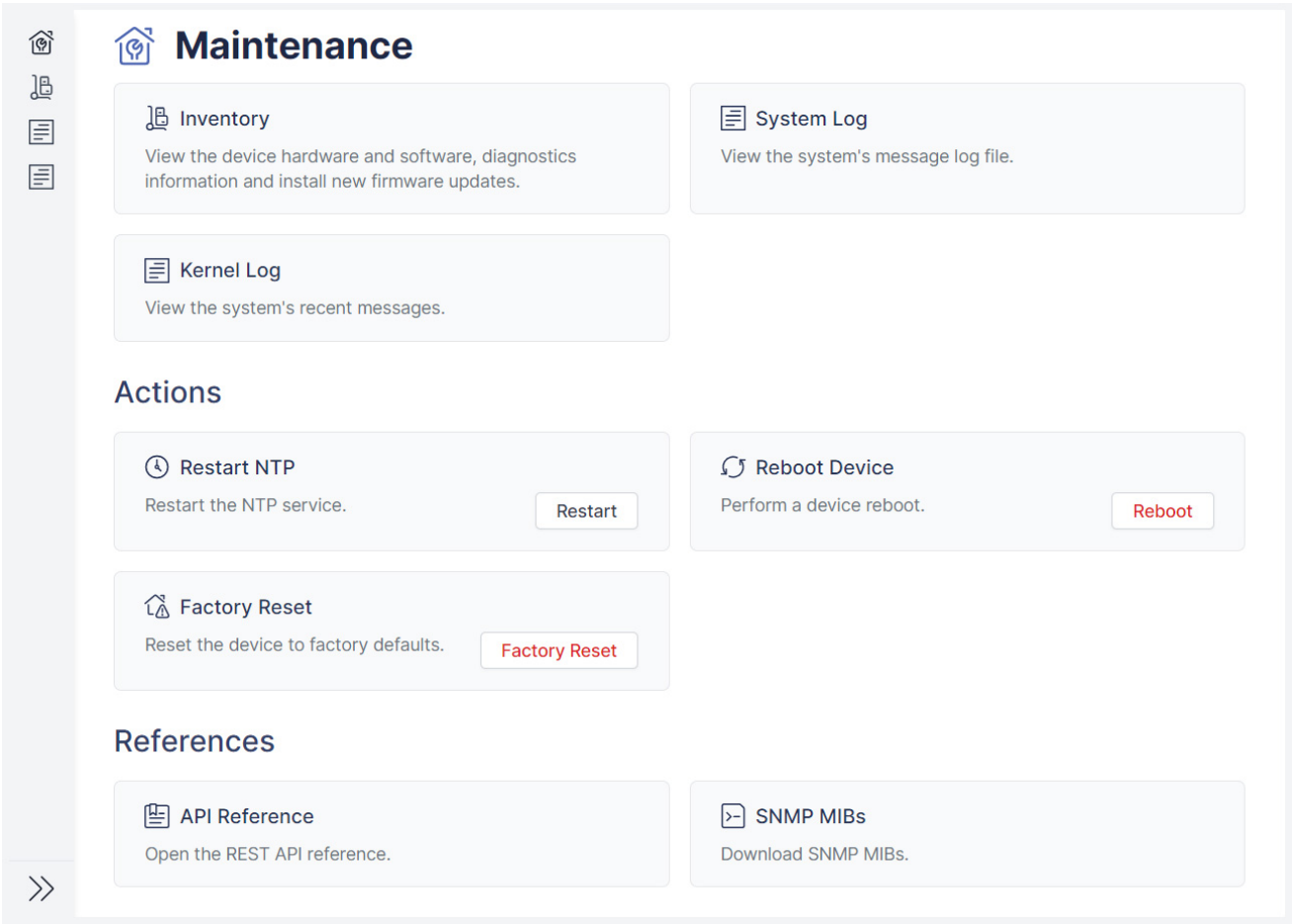

Figure 8.1: meinbergOS Web Interface: "Maintenance" Section

The **Maintenance** section (Fig. 8.1) hosts general system-related monitoring, diagnostic, logging, and management functions that are not directly related to your meinbergOS device's function as a timekeeping or clock management system and are, as the name suggests, purely related to the maintenance and care of your system.

8.1 Maintenance - Inventory

The "**Maintenance** → **Inventory**" subsection provides general information about the hardware of the meinbergOS device, the option to download a diagnostics file for support purposes, and information about the installed firmware, along with the ability to install new firmware versions or re-enable past versions of installed firmware.

8.1.1 Maintenance - Inventory - Overview

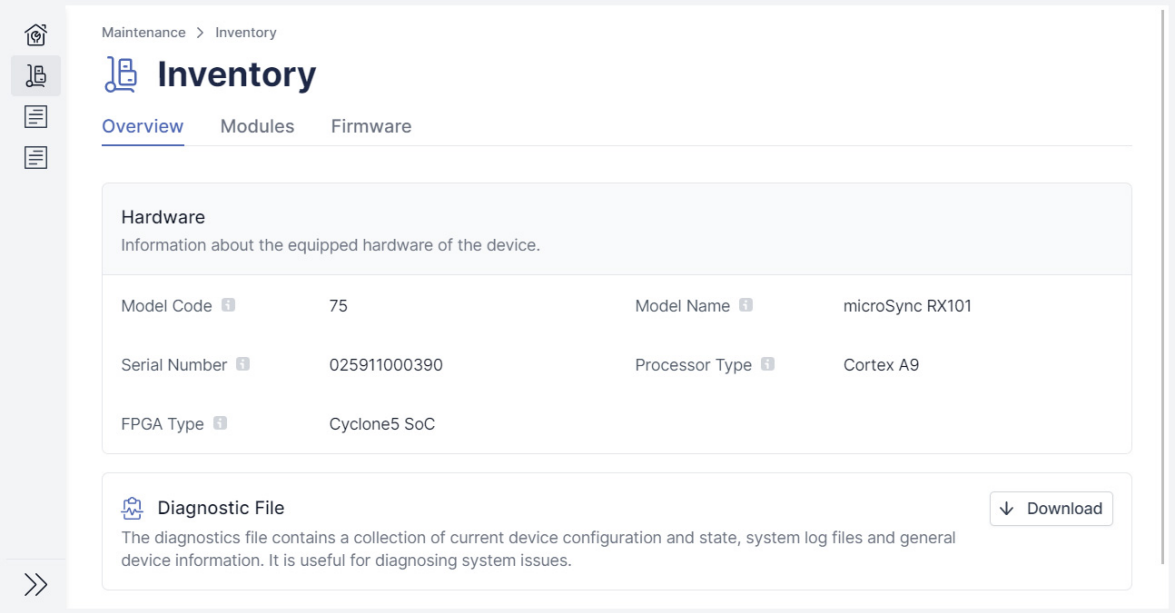

Figure 8.2: meinbergOS Web Interface: "Maintenance → Inventory → Overview" Tab

Hardware

Information about the hardware underlying your meinbergOS device.

Model Code: The specific product identifier for this meinbergOS device. This relates specifically to the **Model Name** below.

Model Name: The brand name of this meinbergOS device under which it is marketed.

Serial Number: The unique serial number of the device. This information is relevant when contacting Meinberg for support or downloads.

Processor Type: The type of central processing unit (CPU) in the device.

FPGA Type: The type of field-programmable gate array (FPGA) in the device.

Diagnostics File

This option allows you to download a diagnostics file containing a collection of files providing up-to-date device configuration and status information, system log files, and general device information that is often useful for diagnosing system issues. The diagnostics file is provided as a *.tar.gz* archive.

When contacting Meinberg Technical Support for assistance with your meinbergOS device, you may be prompted to download and send this archive for further analysis.

8.1.2 Maintenance - Inventory - Modules

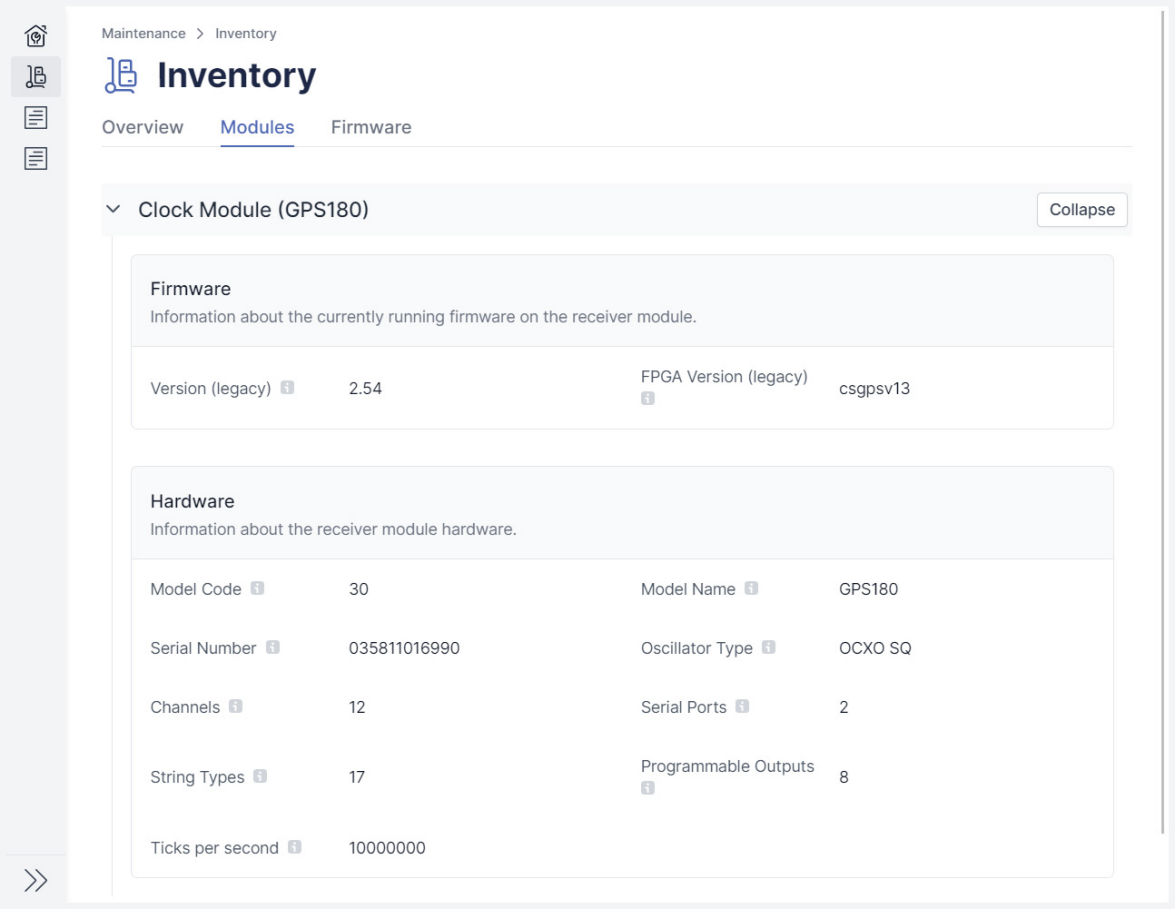

Figure 8.3: meinbergOS Web Interface: "Maintenance → Inventory → Modules" Tab

This tab provides information about the hardware and firmware of the modules integrated into your meinbergOS device, specifically the clock module and any other I/O modules that your device may feature.

Clock Module

Information on the receiver module integrated in the meinbergOS device.

Firmware

Version (Legacy): This is the version number of the clock module firmware.

FPGA Version (Legacy): This is the version number of the integrated FPGA.

Hardware

Model Code: The manufacturer's product model code for the clock module.

Model Name: The product name assigned by the manufacturer for the clock module.

Serial Number: The serial number of the clock module.

Oscillator Type: The type of oscillator integrated into the clock module.

Channels: This value specifies how many satellites the clock module is capable of tracking simultaneously.

Serial Ports: Number of serial interfaces provided by the internal clock module.

String Types: Number of string types supported by the clock module and outputtable through the serial port.

Programmable Outputs: Number of programmable outputs provided by the device.

Ticks per Second: The maximum timing resolution supported by the clock module.

IO Modules

Information on any I/O modules integrated into the meinbergOS device.

Firmware

Version (Legacy): This is the version number of the I/O module firmware.

FPGA Version (Legacy): This is the version number of the integrated FPGA.

Hardware

Model Code: The manufacturer's product model code for the I/O module.

Model Name: The product name assigned by the manufacturer for the I/O module.

String Types: Number of string types supported by the I/O module and outputtable through the serial port.

Ticks per Second: The maximum timing resolution supported by the I/O module.

8.1.3 Maintenance - Inventory - Firmware

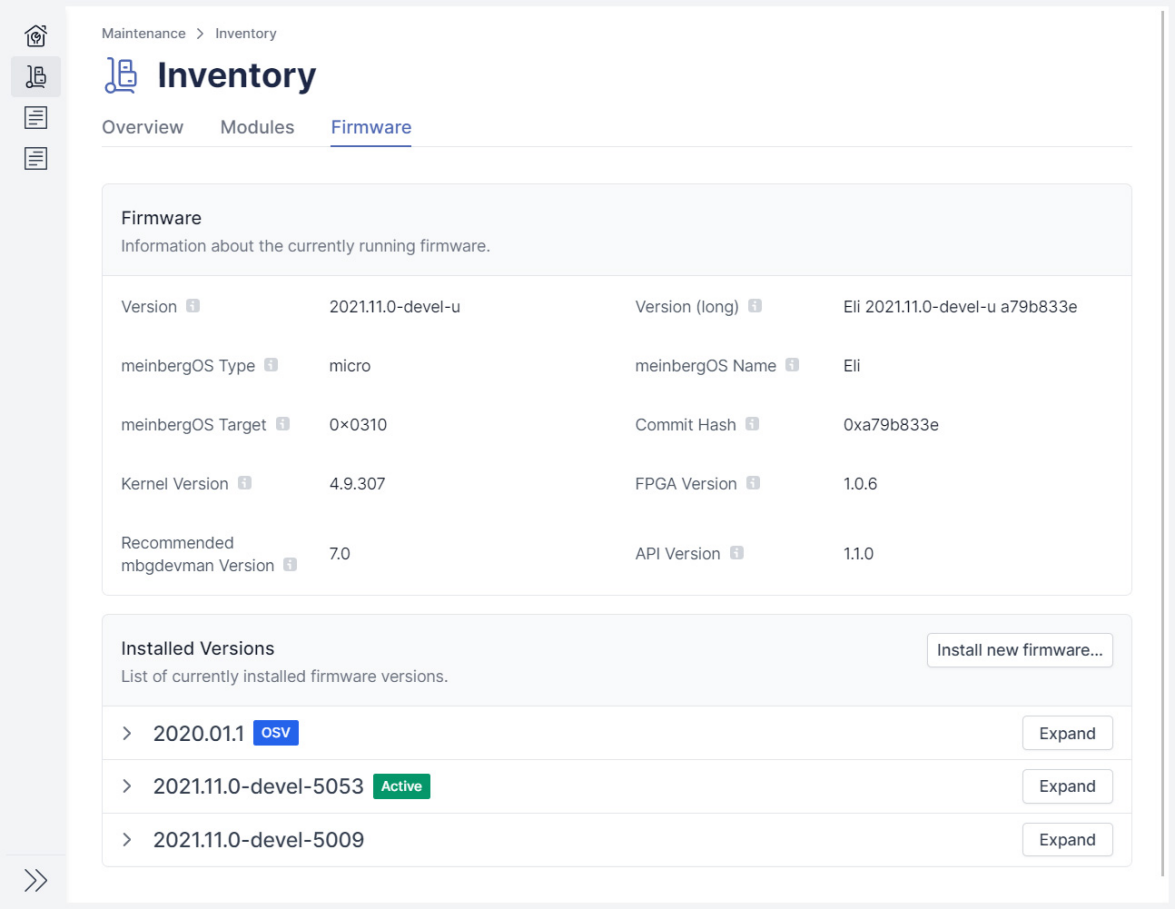

Figure 8.4: meinbergOS Web Interface: "Maintenance → Inventory → Firmware" Tab

This tab (Fig. 8.4) provides information on the currently installed and activated firmware version, as well as any other installed versions that are not active. It also provides the ability to install a new firmware version, to re-activate a previously installed and disabled version, and to remove old versions that are no longer needed.

Firmware

This provides information on the currently activated firmware.

Version: The firmware version number that is currently activated and running.

meinbergOS Type: The type of meinbergOS build that is currently running on this device.

meinbergOS Name: The code name of the meinbergOS main version that is currently activated and running.

Kernel Version: meinbergOS is based on the Linux Kernel, and this is the version of the Linux Kernel currently installed. Please note that the Linux Kernel is updated concurrently with firmware updates; it cannot be updated individually.

FPGA Version: The version of the FPGA firmware currently running.

Recommended mbgdevman Version: The version of Meinberg Device Manager that is recommended for the configuration and monitoring of this device. Meinberg Device Manager is a freely available tool designed to facilitate the management of multiple Meinberg devices in a single network. Please visit **http://www.mbg.link/mbgdevman** for more information.

API Version: The version of the RESTful API used in the currently activated firmware.

Installed Versions

This is the list of currently installed firmware versions. The version that is marked with a green **Active** tag is the firmware version that is currently activated on your meinbergOS device. The version that is marked with a blue **OSV** tag is the firmware version that your meinbergOS device was originally shipped with.

The following information is provided for each firmware version installed:

Version: The version number of this firmware.

Build Number: The Build Number of this firmware version. This is a development-specific value that you may be prompted to provide when contacting Meinberg Technical Support.

Build Date: The date and time of this build of the firmware version.

Is OSV: If this firmware version is the version that the meinbergOS device shipped with, this will show *Yes*. To ensure that your system always has a stable build to fall back in the event of problems, this version cannot be erased from your system.

Is Active: If this is the currently activated version of meinbergOS, this will show *Yes*.

Is Erasable: If this firmware version can be erased, this will show *Yes*. Any firmware can generally be erased if it is not the OSV and not the currently activated version.

Is Mutable: If individual files within this firmware version (i.e., module firmware updates) can be updated, added, deleted, etc. this will show *Yes*.

Module Updates: This shows which individual module firmware updates are included in this firmware version (e.g., clock receiver), specifically the name of the module and the firmware version.

8.1.3.1 Guide: Installing a New Firmware Version

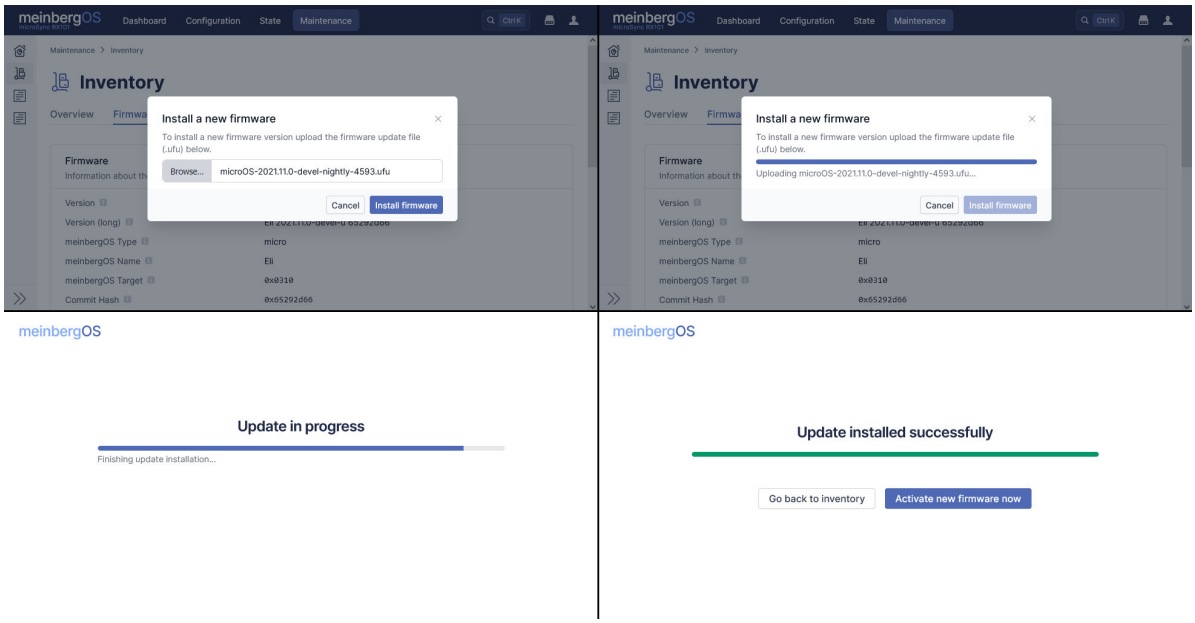

Figure 8.5: meinbergOS Web Interface: Installing a New Firmware Version

Information:

Before activating another version of meinbergOS, remember to save any configuration changes as the Startup Configuration if you wish to keep them; any unsaved changes will be lost.

You may have a maximum of five meinbergOS versions installed at any one time.

Firmware updates are provided by Meinberg for your meinbergOS device in the form of files with a *.ufu* extension. If you wish, you may install a meinbergOS firmware update by clicking on the **Install New Firmware...** button at the top right of the **Installed Versions** panel (Fig. 8.4). You will then be prompted to select the *.ufu* firmware update file; click on **Browse...** in the dialog box that appears (Fig. 8.5, top left) and select the file using the file browser. Confirm that the correct file name appears in the corresponding field, then click on the blue **Install Firmware** button to proceed (Fig. 8.5, top right).

The installation process will take a brief moment (Fig. 8.5, bottom left) . Once completed, you will be informed that the update has been successfully installed and can now select whether you wish to activate this new firmware or return to the Firmware Inventory for now (Fig. 8.5, bottom right).

Please note that it can take a few moments to activate the newly installed firmware because the system needs to be rebooted for this purpose. As soon as the system is available again, your browser should automatically load the login page. If the login page does not appear after two minutes, try and force a reload by refreshing your browser.

8.1.3.2 Guide: Removing a Firmware Version from the Inventory

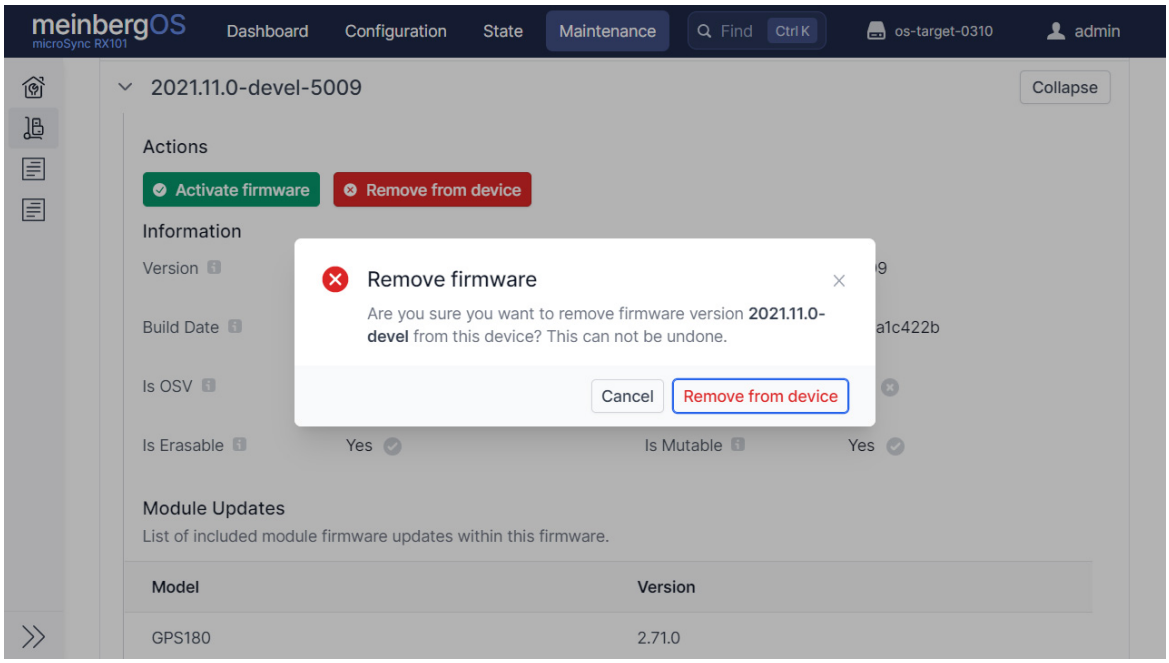

Figure 8.6: meinbergOS Web Interface: Removing a Firmware Version

If you wish to remove an old firmware version from your inventory, you can do so by clicking on the red **Remove from Device** button under the corresponding firmware version in the list. Please note that this process is permanent and cannot be undone; if you do not have the corresponding *.ufu* firmware update file stored elsewhere, you will not be able to recover this version again.

It is not possible to remove the Original Shipped Version (OSV) or the currently active version of the firmware; the **Remove from Device** button will therefore be grayed out for that version of the firmware.

8.1.3.3 Guide: Activating an Installed Firmware Version

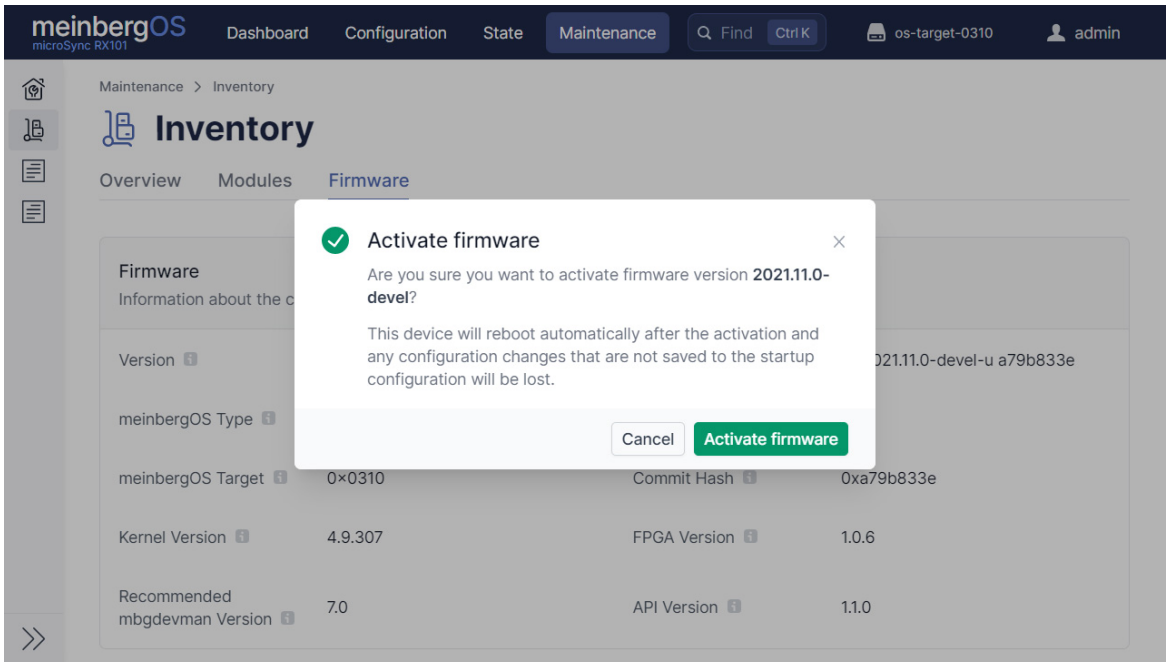

Figure 8.7: meinbergOS Web Interface: Activating a Firmware Version

If you wish to activate a different firmware version that is already installed on your system, you can do so by clicking on the firmware version in the list to open it, then clicking on the green **Activate Firmware** button underneath the relevant firmware version (Fig. 8.7). The system will then advise you that it will need to reboot in order to apply the firmware version and that any configuration changes will be lost if they are not saved as the Startup Configuration.

Information:

Activating an older version of meinbergOS in which newer features are missing will cause the configuration for those features to be lost as soon as a new configuration is saved under that older meinbergOS version.

Important!

Older versions of meinbergOS prior to *2022.05.1* did not feature a Web Interface and were only accessible using Meinberg Device Manager or over SSH/Telnet. Activating a version of meinbergOS older than *2022.05.1* that pre-dates the introduction of the Web Interface will cause you to lose access to the Web Interface. In this case, you will need to reactivate or reinstall a newer version of meinbergOS using Meinberg Device Manager to regain access to the Web Interface.

Visit **https://mbg.link/mbgdevman** for more information.

8.2 Maintenance - System Log

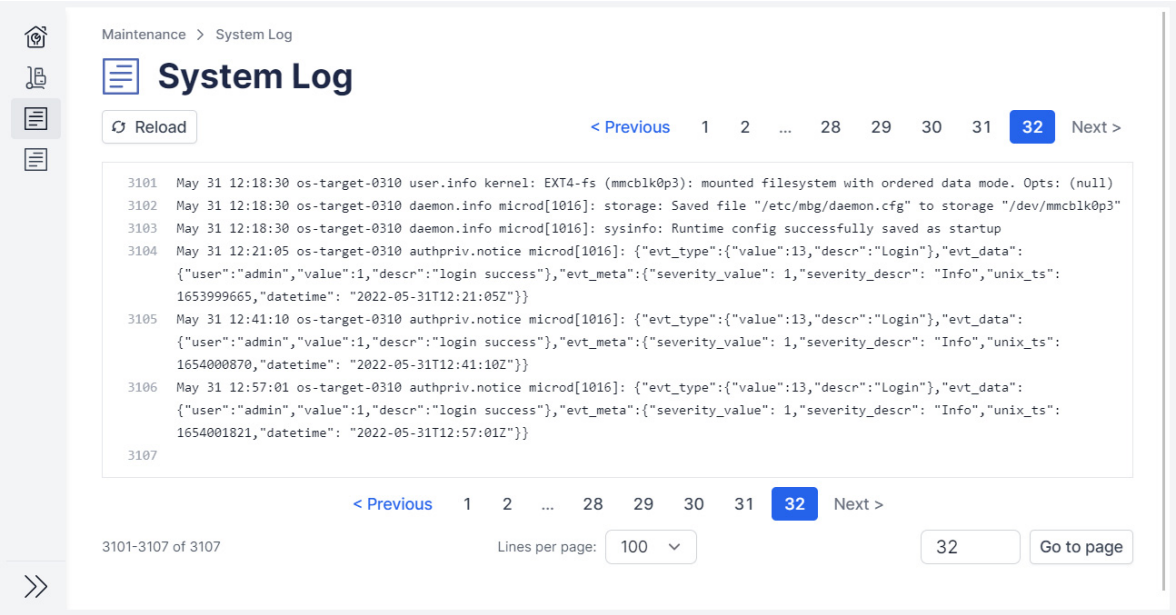

Figure 8.8: meinbergOS Web Interface: System Log

The "**Maintenance** → **System Log**" subsection (Fig. 8.8) provides access to the device's system log, which provides information such as past logins (both successful and failed), file system access, and cryptographic processes. This information can be useful for security and other analyses, and when contacting Meinberg Technical Support, you may be prompted to provide a copy of it.

Information:

The user must have the **Shell** channel permission to be able to read the System Log. Refer to the chapter "**Configuration - Users**" for further information.

8.3 Maintenance - Kernel Log

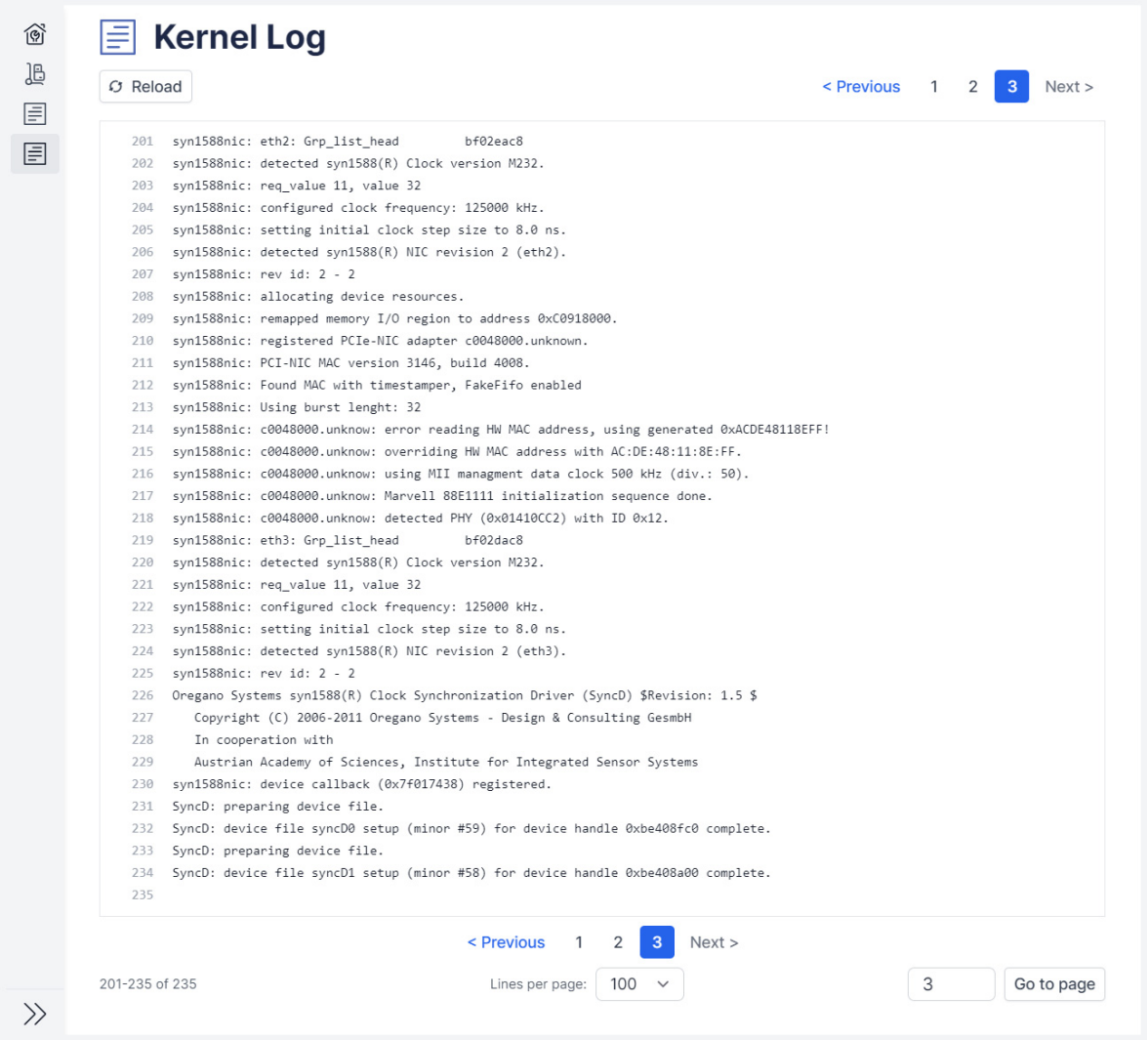

Figure 8.9: meinbergOS Web Interface: Kernel Log

The "**Maintenance** → **Kernel Log**" (Fig. 8.9) subsection provides access to the device's Linux Kernel log, which mainly provides hardware-related information. This information can be useful for system diagnosis, and you may be prompted to provide a copy of it when contacting Meinberg Technical Support.

Information:

The user must have the **Shell** channel permission to be able to read the Kernel Log. Refer to the chapter "**Configuration - Users**" for further information.

8.4 Maintenance - Restart NTP

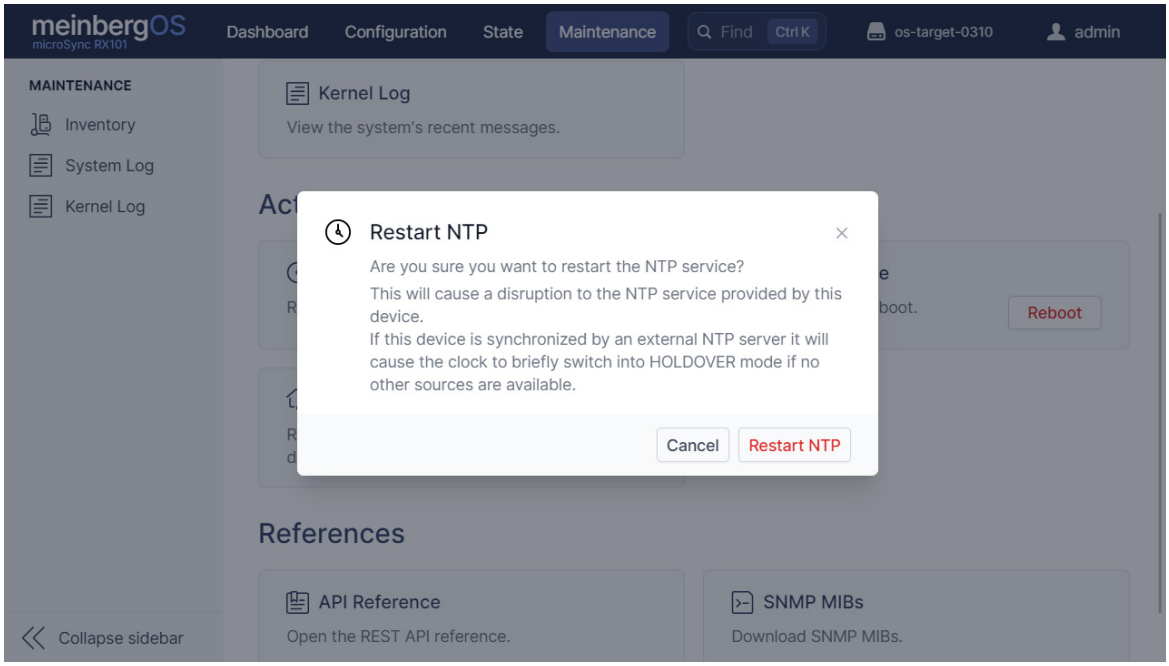

Figure 8.10: meinbergOS-Webinterface: Restart NTP-Service

If the meinbergOS device's NTP service is malfunctioning in any way and you do not wish to disrupt the other timekeeping or clock synchronization functionality, you may restart the internal NTP service individually using this button.

Information:

If the meinbergOS device is exclusively synchronized by an external NTP source, restarting the NTP service will briefly cause the clock module to switch to Holdover Mode until the NTP service is re-established.

8.5 Maintenance - Reboot Device

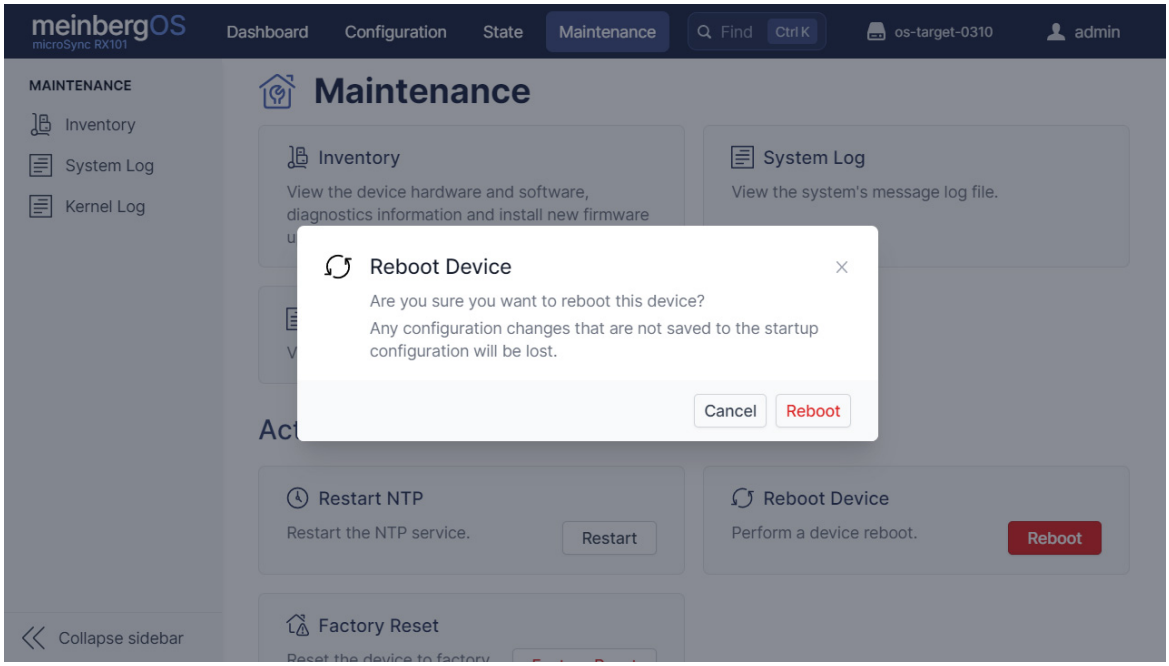

Figure 8.11: meinbergOS Web Interface: Reboot Device

The **Reboot Device** button can be used to restart the meinbergOS device as needed (Fig. 8.11). A reboot may help to resolve certain problems and can reset certain other states; for example, if a short-circuit has been detected in the antenna connection, the meinbergOS device will need to be rebooted once the cause of the short-circuit has been eliminated.

Information:

Changes to the current configuration will be lost upon rebooting the device unless they have been saved as the Startup Configuration.

8.6 Maintenance - Factory Reset

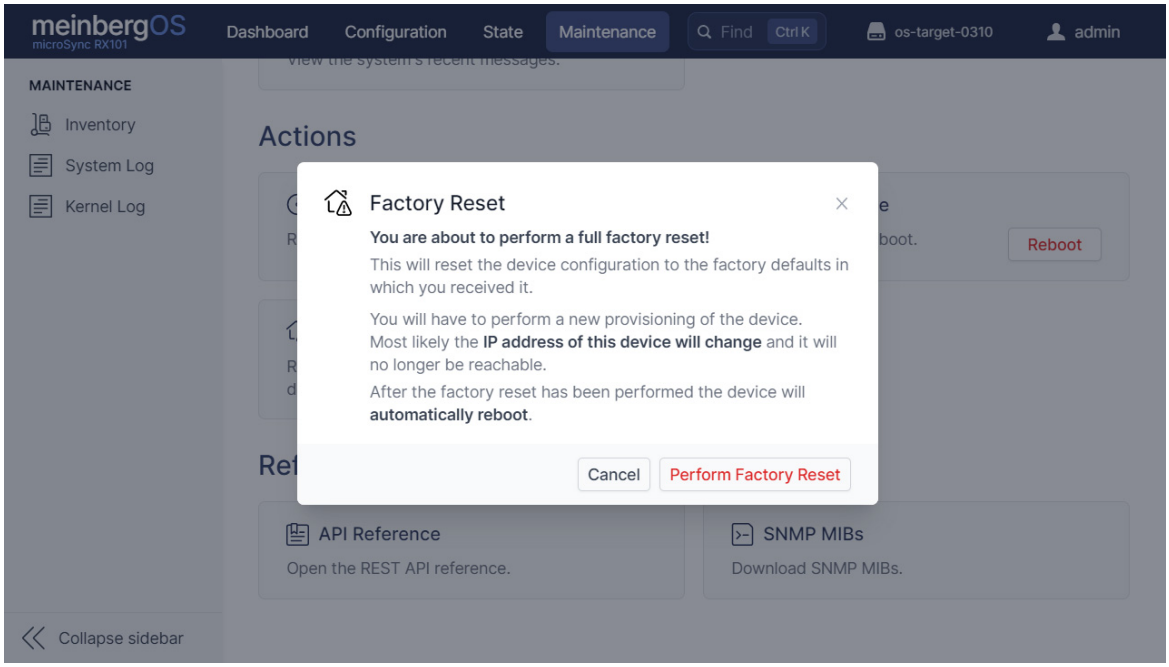

Figure 8.12: meinbergOS Web Interface: Factory Reset

This option will perform a full factory reset of the meinbergOS device and restore the configuration as it was at the time of shipping. This will cause the erasure of all data, namely the system configuration (including the Startup Configuration), almanac data, system and kernel logs. It will also delete all user profiles and reinstate the *admin* account with its default password *timeserver*.

After a factory reset, all installed firmware versions remain installed and the activated version remains activated. The **Factory Reset** function does **not** restore the activated firmware version to the Originally Shipped Version (OSV).

Important!

Depending on your network configuration, a factory reset may render your meinbergOS device inaccessible from the device from which you perform the factory reset. In this case, you may need to establish a direct wired connection with the meinbergOS device.

Please refer to the manual of your meinbergOS device for further information on re-configuring your meinbergOS device's network settings.

8.7 Maintenance - API Reference

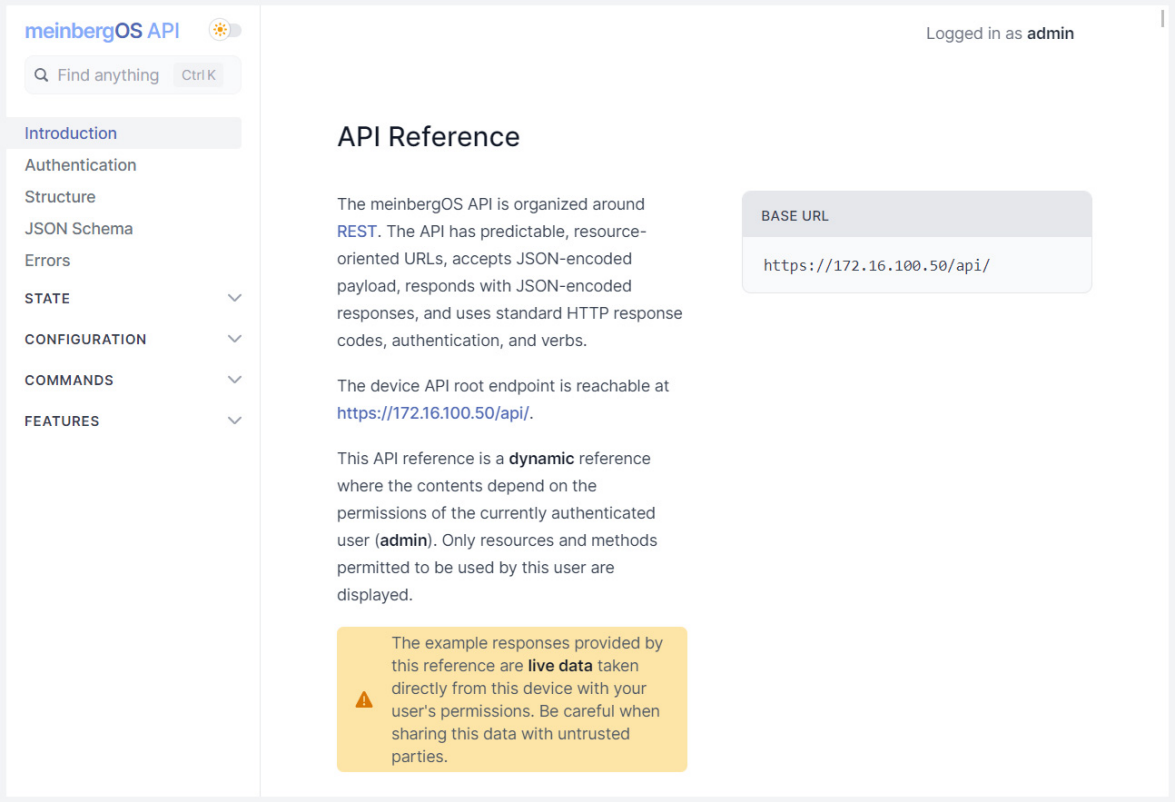

Figure 8.13: meinbergOS-Web Interface: API Reference

Selecting the **API Reference** button will open a reference guide that provides detailed information about the RESTful API that external applications can use to interact securely and logically with the meinbergOS device via *HTTPS*.

8.8 Maintenance - SNMP MIBs

This provides access to the Meinberg root and meinbergOS-specific MIB files (Management Information Base); these are downloadable directly from the meinbergOS device and define the network objects usable by a suitable SNMP management solution for the purpose of remotely monitoring the meinbergOS device.

9 Your Opinion Matters to Us

This user manual is intended to assist you with the setup and use of software for use with your Meinberg product. We hope that it provides you with all of the information that you require to properly and efficiently use your Meinberg product to its fullest potential.

Be a part of the ongoing improvement of the information contained in this manual. Please contact our Technical Support team if you have any suggestions for improvements or technical questions that are relevant to the manual.

Meinberg – Technical Support

Phone: +49 (0) 5281 – 9309- 888
Email: techsupport@meinberg.de

10 Technical Appendix

10.1 Description of Time String Formats

10.1.1 Format of the Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the <STX> (start-of-text) character and ending with the <ETX> (end-of-text) character. The format is as follows:

<STX>D:*dd.mm.yy;T:w;U:hh.mm.ss;uvxy*<ETX>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

<STX> Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of the Century	(00–99)

w The day of the week (1–7, 1 = Monday)

hh.mm.ss The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)

uv Clock status characters (depending on clock type):

u:	'#'	GPS: Clock is in free-run mode (no exact synchronization) PZF: Time frame not synchronized DCF77: Clock has not synchronized since last reset
	' '	(space, 20h) GPS: Clock is synchronized (base accuracy is reached) PZF: Time frame is synchronized DCF77: Clock has synchronized since last reset
v:	'*'	GPS: Receiver has not checked its position PZF/DCF77: Clock currently running off XTAL
	' '	(space, 20h) GPS: Receiver has determined its position PZF/DCF77: Clock is syncronized with transmitter

x time zone indicator:

'U'	UTC	Universal Time Coordinated, formerly GMT
' '	CET	European Standard Time, daylight saving disabled
	'S'	(CEST) European Summertime, daylight saving enabled

y Announcement of clock jump during last hour before jump enters effect:

'!'	Announcement of start or end of Daylight Saving Time
'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

<ETX> End-of-Text, ASCII code 03h

10.1.2 Format of the Meinberg GPS Time String

The Meinberg GPS Time String is a sequence of 36 ASCII characters starting with the **<STX>** (start-of-text) character and ending with the **<ETX>** (end-of-text) character. Unlike the Meinberg Standard Time String, the Meinberg GPS Time String does not carry any local time zone or UTC data; it simply carries the direct GPS time without any conversion into UTC. The format is as follows:

<STX>D:*dd.mm.yy;T:w;U:hh.mm.ss;uvGy;lll*<ETX>

The letters printed in *italics* are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

<STX> Start-of-Text, ASCII code 02h

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of the Century	(00–99)

w the day of the week (1–7, 1 = Monday)

hh.mm.ss the current time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 while leap second)

uv Clock status characters:

u:	'#'	Clock is in free-run mode (no exact synchronization)
	' '	(Space, 20h) Clock is synchronized (base accuracy is achieved)
v:	'*'	Receiver has not checked its position
	' '	(Space, 20h) Receiver has determined its position

G 'GPS time' time zone indicator

y Announcement of clock jump during last hour before jump enters effect:
before discontinuity comes in effect:

'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

lll Number of leap seconds between UTC and GPS Time
(UTC = GPS time + number of leap seconds)

<ETX> End-of-Text, ASCII code 03h

10.1.3 Format of the Meinberg Capture String

The Meinberg Capture String is a sequence of 31 ASCII characters terminated by a <CR>/<LF> (Carriage Return/Line Feed) combination. The format is as follows:

CH*x_dd.mm.yy_hh:mm:ss.fffffff*<CR><LF>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

x	0 or 1 corresponding on the number of the capture input
_	Space, ASCII code 20h

dd.mm.yy Capture date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of the Century	(00–99)

hh:mm:ss.fffffff Capture time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 while leap second)
fffffff	Fractions of Second, 7 Digits	

<CR>	Carriage Return, ASCII code 0Dh
<LF>	Line Feed, ASCII code 0Ah

10.1.4 Format of the SAT Time String

The SAT Time String is a sequence of 29 ASCII characters starting with the **<STX>** (start-of-text) character and ending with the **<ETX>** (end-of-text) character. The format is as follows:

<STX>*dd.mm.yy*/*w*/*hh:mm:ss*x*x*x*x*u*v<ETX>**

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

<STX>	Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second		
dd.mm.yy	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yy	Year of the Century	(00–99)
w	The day of the week (1–7, 1 = Monday)		
hh:mm:ss	The time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
xxxx	Time zone indicator:		
	'UTC'	Universal Time Coordinated, formerly GMT	
	'CET'	European Standard Time, daylight saving disabled	
	'CEST'	European Summertime, daylight saving enabled	
u	Clock status characters:		
	'#'	Clock has not synchronized since last reset	
	' '	(Space, 20h) Clock has synchronized since last reset	
v	Announcement of clock jump during last hour before jump enters effect:		
	'!'	Announcement of start or end of Daylight Saving Time	
	' '	(Space, 20h) nothing announced	
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		
<ETX>	End-of-Text, ASCII code 03h		

10.1.5 Format of the Uni Erlangen String (NTP)

The Uni Erlangen String (NTP) of a GPS clock is a sequence of 66 ASCII characters starting with the **<STX>** (start-of-text) character and ending with the **<ETX>** (end-of-text) character. The format is as follows:

<STX>*dd.mm.yy; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.llle hhhhm*<ETX>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

<STX> Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of Century	(00–99)

w Day of the week (1–7, 1 = Monday)

hh.mm.ss The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)

v -/+ sign of the offset of local timezone relative to UTC

oo:oo Offset of local time zone relative to UTC in hours and minutes

ac Clock status characters:

a:	'#'	Clock has not synchronized since reset
	' '	(Space, 20h) Clock has synchronized since reset
c:	'*'	GPS receiver has not checked its position
	' '	(Space, 20h) GPS receiver has determined its position

d Time zone indicator:

'S'	CEST	European Summertime, Daylight Saving Time enabled
' '	CET	European Standard Time, Daylight Saving Time disabled

f Announcement of clock jump during last hour before jump enters effect:

'!'	Announcement of start or end of Daylight Saving Time
' '	(Space, 20h) nothing announced

g Announcement of clock jump during last hour before jump enters effect:

'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

i Leap second insertion

'L'	Leap second is currently to be inserted (only active in 60th second)
' '	(Space, 20h) No leap second to be inserted

bbb.bbbb Geographical latitude of receiver position in degrees
Leading characters padded by Space characters (20h)

n Latitudinal hemisphere, with the following characters possible:

'N'	North of Equator

	'S' South of Equator
lll.llll	Geographical longitude of receiver position in degrees Leading characters padded by Space characters (20h)
e	Longitudinal hemisphere, with the following characters possible: 'E' East of Greenwich Meridian 'W' West of Greenwich Meridian
hhhh	Altitude above WGS84 ellipsoid in meters Leading characters padded by Space characters (20h)
<ETX>	End-of-Text, ASCII code 03h

10.1.6 Format of the NMEA 0183 String (RMC)

The NMEA 0183 RMC String is a sequence of 65 ASCII characters starting with the string '$GPRMC' and ending with the characters **<CR>** (Carriage Return) and **<LF>** (Line Feed). The format is as follows:

$GPRMC,*hhmmss.ff*,*A*,*bbbb.bb*,*n*,*lllll.ll*,*e*,*0.0*,*0.0*,*ddmmyy*,*0.0*,*a*hh**<CR><LF>**

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

$ — Start character, ASCII code 24h
sent with one-bit accuracy at the change of each second

GP — Talker ID, in this case "GP" for GPS

RMC — Message type ID, in this case "RMC"

hhmmss.ss — The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 while leap second)
ff	Fractions of Seconds	(1/10 ; 1/100)

A — Status (A = Time Data Valid, V = Time Data not Valid)

bbbb.bb — Geographical latitude of receiver position in degrees
Leading characters padded by Space characters (20h)

n — Latitudinal hemisphere, with the following characters possible:

'N'	North of Equator
'S'	South of Equator

lllll.ll — Geographical longitude of receiver position in degrees
Leading characters padded by Space characters (20h)

e — Longitudinal hemisphere, with following characters possible:

'E'	East of Greenwich Meridian
'W'	West of Greenwich Meridian

0.0,0.0 — Speed over the ground in knots and track angle in degrees.
With a Meinberg GPS clock, these values are always 0.0,
With GNS clocks, the values are calculated by the
receiver for mobile applications

ddmmyy — The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of the Century	(00–99)

a — Magnetic Variation E/W

hh — Checksum (XOR of all characters except '$' and '*')

<CR> — Carriage Return, ASCII code 0Dh

<LF> — Line Feed, ASCII code 0Ah

10.1.7 Format of the NMEA 0183 String (GGA)

The NMEA 0193 GGA String is a sequence of characters starting with the string '$GPGGA' and ending with the characters **<CR>** (Carriage Return) and **<LF>** (Line Feed). The format is as follows:

$GPGGA,*hhmmss.ff,bbbb.bbbbb,n,lllll.ll,e,A,vv,hhh.h,aaa.a,M,ggg.g,M,,0*cs*<CR><LF>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

$	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second		
GP	Talker ID, in this case "GP" for GPS		
GGA	Message type ID, in this case "GGA"		
hhmmss.ss	The time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 while leap second)
	ff	Fractions of Seconds	(1/10 ; 1/100)
bbbb.bbbbb	Geographical latitude of receiver position in degrees Leading characters padded by Space characters (20h)		
n	Latitudinal hemisphere, with the following characters possible:		
	'N'	North of Equator	
	'S'	South of Equator	
lllll.llllll	Geographical longitude of receiver position in degrees Leading characters padded by Space characters (20h)		
e	Longitudinal hemisphere, with following characters possible:		
	'E'	East of Greenwich Meridian	
	'W'	West of Greenwich Meridian	
A	Position fixed (1 = yes, 0 = no)		
vv	Number of satellites used (0–12)		
hhh.h	HDOP (Horizontal Dilution of Precision)		
aaa.h	Mean Sea Level Altitude (MSL Altitude = WGS84 Altitude - Geoid Separation)		
M	Units, Meters (Fixed Value)		
ggg.g	Geoid Separation (WGS84 Altitude - MSL Altitude)		
M	Units, Meters (Fixed Value)		
cs	Checksum (XOR of all characters except '$' and '*')		
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

10.1.8 Format of the NMEA 0183 String (ZDA)

The NMEA 0183 ZDA String is a sequence of 38 ASCII characters starting with the string **'$GPZDA'** and ending with the characters **<CR>** (Carriage Return) and **<LF>** (Line Feed). The format is:

$GPZDA,*hhmmss.ss,dd,mm,yyyy,HH,II*cs<CR><LF>

ZDA - Time and Date: UTC, day, month, year and local time zone.

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

$ Start character, ASCII Code 24h
sending with one bit accuracy at change of second

hhmmss.ss UTC time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)

HH,II The local time zone (offset to UTC):

HH	Hours	(00–±13)
II	Minutes	(00–59)

dd,mm,yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yyyy	Year	(0000–9999)

cs Checksum (XOR of all characters except '$' and '*')

<CR> Carriage Return, ASCII code 0Dh

<LF> Line Feed, ASCII code 0Ah

10.1.9 Format of the ABB SPA Time String

The ABB SPA Time String is a sequence of 32 ASCII characters starting with the characters "**>900WD**" and ending with the **<CR>** (Carriage Return) character. The format is as follows:

>900WD:*yy-mm-tt_hh.mm;ss.fff:cc*<CR>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

yy-mm-tt The date:

yy	Year of the Century	(00–99)
mm	Month	(01–12)
dd	Day of Month	(01–31)
_	Space (ASCII code 20h)	

hh.mm;ss.fff The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)
fff	Milliseconds	(000–999)

cc Checksum calculated as XOR sum of the preceding characters. The resultant 8-bit value is reported as a hex value in the form of two ASCII characters (2 ASCII characters 0..9 or A..F)

<CR> Carriage Return, ASCII Code 0Dh

10.1.10 Format of the Computime Time String

The Computime Time String is a sequence of 24 ASCII characters starting with the T character and ending with the **<LF>** (Line Feed, ASCII code 0Ah) character. The format is as follows:

T:*yy:mm:dd:ww:hh:mm:ss*<CR><LF>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

T — Start character
sent with one-bit accuracy at the change of each second

yy:mm:dd — The date:

yy	Year of Century	(00–99)
mm	Month	(01–12)
dd	Day of Month	(01–31)
ww	Day of Week	(01–07, 01 = monday)

hh:mm:ss — The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)

<CR> — Carriage Return, ASCII code 0Dh

<LF> — Line Feed, ASCII code 0Ah

10.1.11 Format of the RACAL Standard Time String

The RACAL Standard Time String is a sequence of 16 ASCII characters started by a X (58h) character and ending with the **<CR>** (Carriage Return, ASCII code 0Dh) character. The format is as follows:

<X><G><U>*yymmddhhmmss*<CR>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

<X>	Control character Sent with one-bit accuracy at the change of each second		Code 58h
<G>	Control character		Code 47h
<U>	Control character		Code 55h
yymmdd	Current date:		
	yy	Year of Century	(00–99)
	mm	Month	(01–12)
	dd	Day of Month	(01–31)
hh:mm:ss	Current time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
<CR>	Carriage Return, ASCII Code 0Dh		

10.1.12 Format of the SYSPLEX-1 Time String

The SYSPLEX-1 time string is a sequence of 16 ASCII characters starting with the **<SOH>** (Start of Header) ASCII control character and ending with the **<LF>** (Line Feed, ASCII code 0Ah) character.

Please note:
To ensure that the time string can be correctly output and displayed through any given terminal program, a singular "C" (not include quotation marks) must be input.

The format is:

<SOH>ddd:hh:mm:ssq<CR><LF>

The letters printed in italics are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

<SOH>	Start of Header, ASCII code 01h sent with one-bit accuracy at the change of each second		
ddd	Day of Year		(001–366)
hh:mm:ss	Current time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
	q	Quality Indicator	(Space) Time Sync (GPS Lock) (?) No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)		
<LF>	Line Feed (ASCII code 0Ah)		

10.1.13 Format of the ION Time String

The ION time string is a sequence of 16 ASCII characters starting with the **<SOH>** (Start of Header) ASCII control character and ending with the **<LF>** (Line Feed, ASCII code 0Ah) character. The format is as follows:

<SOH>ddd:hh:mm:ssq<CR><LF>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

<SOH>	Start of Header (ASCII control character) sent with one-bit accuracy at the change of each second		
ddd	Day of Year		(001–366)
hh:mm:ss	Current time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 while leap second)
	q	Quality Indicator	(space) Time Sync (GPS Lock) (?) No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)		
<LF>	Line Feed (ASCII code 0Ah)		

10.1.14 Format of the ION Blanked Time String

The ION Blanked Time String is a sequence of 16 ASCII characters starting with the **<SOH>** (Start of Header) ASCII control character and ending with the **<LF>** (Line Feed, ASCII code 0Ah) character. The format is as follows:

<SOH>ddd:hh:mm:ssq<CR><LF>

Important: The blanking interval of is 2 minutes and 30 seconds long and is added every 5 minutes.

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

<SOH>	Start of Header (ASCII control character) sent with one-bit accuracy at the change of each second		
ddd	Day of Year		(001–366)
hh:mm:ss	Current Time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 while leap second)
	q	Quality Indicator	(space) Time Sync (GPS Lock) (?) No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII Code 0Dh)		
<LF>	Line Feed (ASCII Code 0Ah)		

10.1.15 Format of the IRIG-J Timecode

The IRIG-J timecode consists of a string of ASCII characters sent in "701" format:

- 1 Start Bit
- 7 Data Bits
- 1 Parity Bit (odd)
- 1 Stop Bit

The on-time marker of the string is the leading edge of the start bit. The timecode consists of 15 characters, sent once per second at a baud rate of 300 or greater. The format is as follows:

<SOH>*DDD:HH:MM:SS*<CR><LF>

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

<SOH>	"Start of Header" ASCII code (0x01h)
DDD	Day of the year (ordinal date, 1 to 366)
HH, *MM*, *SS*	Time of the start bit, specified in in hours (*HH*), minutes (*MM*), seconds (*SS*)
<CR>	"Carriage Return" ASCII code (0x0Dh)
<LF>	"Line Feed" ASCII code (0x0Ah)

10.2 Description of Time Code Formats

Each IRIG format carries a designation comprising a letter followed by three numerical digits. The letter and each of the digits represents a characteristic property of the corresponding IRIG code.

Depending on your Meinberg product, more or less time code formats are supported.

A002: 1000 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD)

A003: 1000 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD), time of day (SBS)

A132: 1000 pps, AM sine-wave signal, 10 kHz carrier frequency
Time of year (BCD)

A133: 1000 pps, AM sine-wave signal, 10 kHz carrier frequency
Time of year (BCD), time of day (SBS)

B002: 100 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD)

B003: 100 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD), time of day (SBS)

B006: 100 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD), calendar year (BCD)

B007: 100 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD), year, time of day (SBS)

B122: 100 pps, AM sine-wave signal, 1 kHz carrier frequency
Time of year (BCD)

B123: 100 pps, AM sine-wave signal, 1 kHz carrier frequency
Time of year (BCD), time of day (SBS)

B126: 100 pps, AM sine-wave signal, 1 kHz carrier frequency
Time of year (BCD), calendar year (BCD)

B127: 100 pps, AM sine-wave signal, 1 kHz carrier frequency
Time of year (BCD), calendar year (BCD), time of day (SBS)

E002: 10 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD)

E112: 10 pps, AM sine wave signal, 100 Hz carrier frequency
Time of year (BCD)

G002: 10000 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD)

G006: 10000 pps, DCLS, pulse-width coded, no carrier
Time of year (BCD), calendar year (BCD)

G142: 10000 pps, AM sine-wave signal, 100 kHz carrier frequency
Time of year (BCD)

G146: 10000 pps, AM sine-wave signal, 100 kHz carrier frequency
Time of year (BCD), calendar year (BCD)

Abbreviations:
BCD = Binary-Coded Decimal, SBS = Straight Binary Seconds

In addition to the original IRIG standards, there are also other specifications issued by other bodies that define specific extensions.

AFNOR:	Code according to NF S87-500, 100 pps, AM sine-wave signal, 1 kHz carrier frequency, BCD time of year, complete date, SBS time of day, signal level specified by standard.
IEEE 1344:	Code according to IEEE 1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time of year, SBS time of day, IEEE 1344 extensions for date, time zone, Daylight Saving Time, and leap seconds in Control Functions (CF) segment. (See also table "Structure of CF segment in IEEE 1344 mode")
IEEE C37.118:	Identical to IEEE 1344, but with UTC offset +/- sign bit reversed
NASA 36:	100 pps, AM sine wave signal, 1 kHz carrier frequency, resolution: 10 ms (DCLS), 1 ms (modulated carrier) BCD time of year: 30 bits - seconds, minutes, hours, and days

10.3 Description of Programmable Pulse Signal Types

If your Meinberg system has programmable signal and pulse outputs, then depending on the system, more or less of the listed signals will be available. These can be configured separately for each signal output.

Idle
Selecting "Idle" enables that specific output to be disabled.

Timer
In "Timer" mode, the output simulates a timer with a fixed daily schedule. It is possible to configure three switch-on and three switch-off times for each day and each output. In order to set a timer, both the switch-on time ("ON") and the corresponding switch-off time ("OFF") must be set. If the switch-on is later than the switch-off time, the switching scheduler will interpret this to mean that the switch-off time is on the next day, which will keep the signal enabled through midnight.

Thus, if a program was set with a switch-on time of 23:45:00 and a switch-off time of 0:30:00, this would cause the output (e.g., PP 1 Out) to be enabled on day n at 11:45 p.m., and then to be disabled on day n+1 at 12:30 a.m. If any of these three programs are to be left disabled, simply enter the same times into the ON and OFF fields. The "Signal" selector specifies the active state for the timer periods. Selecting "Normal" will put the output in a low state outside of switch-on periods and in a high state during switch-on periods ("active high"). Conversely, selecting "Inverted" will place the output in a high state outside of switch-on periods and in a low state during switch-on periods ("active low").

Single Shot
"Single Shot" mode generates a single pulse of defined length once per day. The time of day when the pulse is to be generated can be set via the "Time" value. The value "Length" allows the pulse length to be set in 10 msec increments and may be any value in the range of 10 ms to 10 sec.

Cyclic Pulse
"Cyclic Pulse" mode is used to generate cyclically repeating pulses. The time between two pulses is defined, and this value must always be provided in hours, minutes, and seconds. It is important to note that the pulse train is always synchronized with 0:00.00 local time, so that the first pulse on any given day will always be output at midnight, and is repeated at the specified cycle interval henceforth. Thus, if a cycle duration of 2 seconds is specified, this will result in pulses being triggered at 0:00.00, 0:00.02, 0:00.04 and so on. While it is possible to set any cycle time between 0 and 24 hours, these repetitions are usually only useful if the time between pulses is always the same. For example, if a cycle time of 1:45.00 is set, this will output pulses at intervals of 6300 seconds. However, between the last pulse of any given day and the pulse at midnight on the following day, there will be an interval of just 4500 seconds.

Pulses Per Second, Per Min, Per Hour
These modes generate pulses of defined length once per second, once per minute, or once per hour. The configuration options for all three modes are the same. The value "Pulse Length" specifies the length of the pulse and can be between 10 msec and 10 sec.

DCF77 Marks
In "DCF77 Marks" mode the selected output simulates the time string transmitted by the German DCF77 time code transmitter. The pulses output are the 100 ms and 200 ms pulses (logical 0/1) typical for the DCF77 code. The absence of the 59-second mark is used to signal that the next minute will begin with the following second mark.

The 'DCF Suspend After'/'Timeout' field can be used to enter how many minutes the system should wait while in free-run mode before DCF77 simulation is suspended. Entering 0 here will disable the timeout function, so that the DCF77 simulation will continue running perpetually until manually disabled.

Sync Mode

There are three different modes available for outputting the synchronization state of the clock.

Position OK
The "Position OK" mode outputs a signal through the output whenever the GPS receiver is receiving enough satellites to determine its position.

Time Sync
In "Time Sync" mode, a signal is passed through the output while the clock's internal timebase is synchronized to the GPS time.

All Sync
The "All Sync" mode requires both of the above states to be true—sufficient satellites for positioning and synchronization of internal timebase to satellite system for a signal to be passed through the output.

DCLS Time Code
DC level shift time code. The time code output here is configured using the "IRIG Settings" tab in the LANTIME OS Web Interface or the "Outputs Settings" section of Meinberg Device Manager.

10 MHz Frequency
This mode is used to output a fixed frequency of 10 MHz, using a PPS signal as an absolute phase reference (i.e., the falling edge of the 10 MHz signal is synchronized with the rising edge of the PPS signal).

DCF77-like M59
A 500 ms pulse is sent at the 59-second mark.

The 'DCF Suspend After'/'Timeout' field can be used to enter how many minutes the system should wait while in free-run mode before DCF77 simulation is suspended. Entering 0 here will disable the timeout function, so that the DCF77 simulation will continue running perpetually until manually disabled.

Synth. Frequency
This mode is used to output a custom frequency, which is also defined using the "Synthesizer" tab in the LANTIME OS Web Interface or the "Outputs Settings" section of Meinberg Device Manager.

PTTI 1PPS
This mode is used to pass a PPS signal of 20 microseconds length through the output.

1 MHz Frequency
This mode is used to output a fixed frequency of 1 MHz, using a PPS signal as an absolute phase reference (i.e., the falling edge of the 10 MHz signal is synchronized with the rising edge of the PPS signal).

5 MHz Frequency
This mode is used to output a fixed frequency of 5 MHz, using a PPS signal as an absolute phase reference (i.e., the falling edge of the 10 MHz signal is synchronized with the rising edge of the PPS signal).

10.4 Supported PTPv2 Profiles

This is a list of the PTPv2 profiles supported by meinbergOS and the settings that meinbergOS applies to ensure compliance with these profile specifications.

PTP Profile	Operation Modes	OSI Layer/Network Protocol	PTP Domain	Delay Mechanism	Announce Receipt Timeout	Announce Interval	Sync Interval	(Peer) Delay Req. Interval	PTP Timescale Required?
Default E2E IEEE1588-2008	Any except Mixed Master	L2/ L3	0–255	E2E	2–10	1 (1/2s)	0 (1/s)	0–7 (1/s–1/128s)	Y
Default P2P IEEE1588-2008	Multicast	L2/ L3	0–255	P2P	2–10	1 (1/2s)	0 (1/s)	0 (1/s)	Y
Power IEEE C37.238-2011	Multicast	L2	0–255	P2P	2–3	0 (1/s)	0 (1/s)	0 (1/s)	Y
Power IEEE C37.238-2017	Multicast	L2	0–254	P2P	3	0 (1/s)	0 (1/s)	0 (1/s)	Y
Utility IEC 61850-9-3	Multicast	L2	0–255	P2P	3	0 (1/s)	0 (1/s)	0 (1/s)	Y
Telecom ITU-T G.8265.1	Unicast Slave/ Master	L3	4–23	E2E	2	n/a	n/a	n/a	N
Telecom ITU-T G.8275.1	Multicast Slave/ Master	L2	24–43	E2E	3–10	-3 (8/s)	-4 (16/s)	-4 (16/s)	Y
Telecom ITU-T G.8275.2	Unicast Slave/ Master	L3	44–63	E2E	2	n/a	n/a	n/a	Y
DOCSIS 3.1	Multicast	L2	24–43	E2E	3–10	-3 (8/s)	-4 (16/s)	-4 (16/s)	Y
SMPTE ST 2059-2	Any	L3	0–127	Any	2–10	-3 to 1 (8/s–1/2s)	-7 to -1 (128/s–2/s)	-7 to -1 (128/s–2/s)	N
AES67 Media	Multicast	UDP/ IPv4 (L3)	0–255	Any	2–10	0 to 4 (1/s–1/16s)	-4 to 1 (16/s–1/2/s)	0 (1/s)	N
IEEE 802.1AS	Multicast	L2	0	P2P	2–10	-4 to 4 (16s–1/16s)	-7 to 7 (128/s–1/128/s)	0 (1/s)	Y

10.5 SSM Quality Levels

When using SyncE, the following flags are used to denote or set the recognized SSM Quality Levels:

QL-STU/UKN:	Quality unknown
QL-PRS:	Primary Reference Source
QL-PRC:	Primary Reference Clock
QL-INV3:	Not used
QL-SSU-A/TNC:	Synchronization Supply Unit A or Transit Node Clock
QL-INV5:	Not used
QL-INV6:	Not used
QL-ST2:	Stratum 2 Clock
QL-SSU-B:	Synchronization Supply Unit B
QL-INV9:	Not used
QL-EEC2/ST3:	Ethernet Equipment Clock 2
QL-EEC1/SEC:	Ethernet Equipment Clock 1 / SDH Equipment Clock
QL-SMC:	SONET Minimum Clock
QL-ST3E:	Stratum 3E Clock
QL-PROV:	Can be provided by network operator
QL-DNU/DUS:	Do not use for synchronization

11 List of Illustrations