TICRO 100

User Manual

Smart Measurement Solutions®

Manual Version: ENU 1098 05 01

This user manual is a publication of OMICRON electronics GmbH.

Contents

Compliance statement

Declaration of Conformity (EU)

The equipment adheres to the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) directive and the RoHS directive.

FCC Compliance (USA)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Declaration of Compliance (Canada)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Recycling

This equipment (including all accessories) is not intended for household use. At the end of its service life, do not dispose of the device with household waste!

For customers in EU countries (incl. European Economic Area)
OMICRON test sets are subject to the EU Waste Electrical and Electronic Equipment Directive (WEEE directive). As part of our legal obligations under this legislation, OMICRON offers to take back the device and ensure that it is disposed of by authorized recycling agents.

For customers outside the European Economic Area
Please contact the authorities in charge for the relevant environmental regulations in your country and dispose the OMICRON device only in accordance with your local legal requirements.

Preface & general safety instructions

This user manual provides information about *TICRO 100*, its possible fields of application and how to install and operate it. Furthermore, it provides information how to access and configure the device using a computer.

Following the instructions given in this user manual will help you to avoid danger, repair costs and down time, and will help to maintain the reliability and life of *TICRO 100*.

Safety symbols used

In this documentation, the following symbols indicate safety instructions for avoiding hazards.

WARNING

Death or severe injury can occur if the appropriate safety instructions are not observed.

CAUTION

Minor or moderate injury may occur if the appropriate safety instructions are not observed.

NOTICE

Equipment damage or loss of data possible.

General safety instructions

Before operating *TICRO 100*, carefully read the following general safety instructions:

- *TICRO 100* may only be used in a safe technical condition taking into account its defined purpose, safety requirements and possible risks as well as the operating instructions given in this user manual.
- *TICRO 100* is exclusively intended for the applications specified in chapter Introduction and designated use on page 8. The manufacturer or the distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risks.
- The instructions provided in this manual are considered part of the rules governing proper usage.
- Do not open *TICRO 100*. Opening the device invalidates all warranty claims.
- Do not carry out any modifications or adaptations to *TICRO 100*.
- Do not use any other power supply options for *TICRO 100* than the ones described in chapter Power supply on page 22.

- *TICRO 100* is a SELV device (Safety Extra Low Voltage) which can be supplied with power by Power over Ethernet (PoE class 3 powered device according to IEEE 802.3af). The ETH network port of *TICRO 100* may only be connected to Ethernet network ports or Power over Ethernet power supplies.
- The FIBER network port and the outputs 4 and 5 are products of laser class 1 (IEC 60825).

WARNING

Death or severe injury caused by high voltages possible.

All inputs and outputs of *TICRO 100* are electrically connected to the SELV (safety extra low voltage) insulation group of the device.

► Do not connect any voltages that are not SELV compliant.

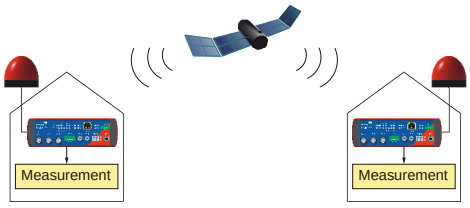
1 Introduction & designated use

TICRO 100 is a Precision Time Protocol (PTP) time converter that allows you to derive a high variety of time codes from IEEE 1588/PTP packages received via Ethernet. This device enables you to easily synchronize non-PTP equipment to the grandmaster clock of an IEEE 1588/PTP infrastructure.

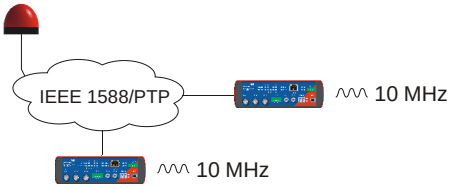
TICRO 100 is designed for the following applications:

- Generation of PTP-synchronized signals to make existing equipment PTP capable.
  TICRO 100 can be used to generate several time synchronization signals (e.g., PPX, IRIG-B, DCF77, etc.) required for existing equipment (e.g., IEDs) from an IEEE 1588/PTP infrastructure.
- Synchronization of measurements.
  TICRO 100 provides programmable trigger functionality that can be used for example to start measurements at different locations at exactly the same time.
- Generation and distribution of 10 MHz reference frequency signals over Ethernet.
  TICRO 100 provides a highly accurate 10 MHz reference signal that can be used to synchronize measurement equipment such as synthesizers, frequency counters or spectrum analyzers to the same frequency reference signal.
- Portable time code generation.
  Together with a portable PTP grandmaster clock (e.g., *OTMC 100* from OMICRON Lab), *TICRO 100* can be used to perform quick time synchronized measurements in the field.

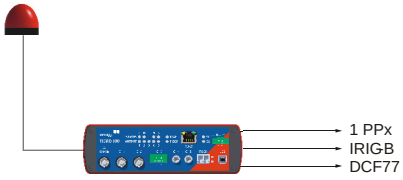
Example: Generation of PTP-synchronized signals for existing equipment



Example: Synchronization of measurements



Example: Generation of 10 MHz reference frequency



Example: Portable time code generation

Key: = PTP grandmaster clock = *TICRO 100*

Features supported by *TICRO 100*:

- Timing features:
  - PTP time stamping resolution 8 ns.
  - Internal oscillator hold-over functionality to bridge up to 24 hours of PTP synchronization loss. (Oscillator options with different accuracies available.)
  - PTPv2 according to IEEE 1588-2008.
    Supported profiles: Default profiles according to IEEE 1588-2008, Power profile acc. to IEEE C37.238-2011, Power profile acc. to IEEE C37.238-2017, Power Utility profile acc. to IEC 61850-9-3:2016.
- Power supply options:
  - Power supply by Power over Ethernet PoE (class 3 powered device according to IEEE 802.3af, max. power consumption < 13 W).
  - Power supply by the delivered plug-in power supply unit and/or by any other 18 ... 57 VDC power supply (details and restrictions see chapter Power supply on page 22). Power supply redundancy possible.
  - If powered by an external power supply mentioned above, *TICRO 100* is able to operate as a power sourcing equipment (PSE) according to IEEE 802.3af. The device is then able to power a class 1 device via its 100BaseTX Ethernet port (e.g. an *OTMC 100* that is directly connected to *TICRO 100*).
- Networking:
  - 10/100Base-TX (twisted-pair) or 100Base-FX (optical fiber) Ethernet
  - IPv4 and IPv6
  - DHCP/Autoconf
  - Zeroconf (mDNS/DNS-SD)
  - OMICRON OMFind service
- Outputs and output signals
  - 3 BNC connectors (50 Ω), 2 optical ST connectors, 1 optocoupler output
  - Possible output signals:
    - PPX: 1, 10, 100 or 1000 PPS (pulses per second), 1 PPM (pulse per minute), 1 PPH (pulse per hour), or user defined pulse frequency from 10 mHz to 2.048 MHz.
    - IRIG-B (unmodulated and modulated on 1 kHz carrier)
    - DCF77 unmodulated
    - Trigger: 1 trigger pulse at a specific point in time or PPX pulse sequence starting at a specific point in time
    - 10 MHz sine wave
- Configuration:
  - Can be accessed with a computer via Ethernet or USB
  - Web Interface (HTTP & HTTPS) with optional password protection

    - Automated configuration via SSH, SOAP and XML files
- Linux operating system:
    - TFTP, FTP and SSH access
    - Syslog (local and remote)
    - E-Mail notifications
- Failsafe software upgrades in the field
- Installation options:
    - Permanent indoor installation on DIN rail or by wall mounting.
    - Portable use in dry environments.

TICRO 100 is exclusively intended for the applications stated in this chapter. Any other use is considered improper.

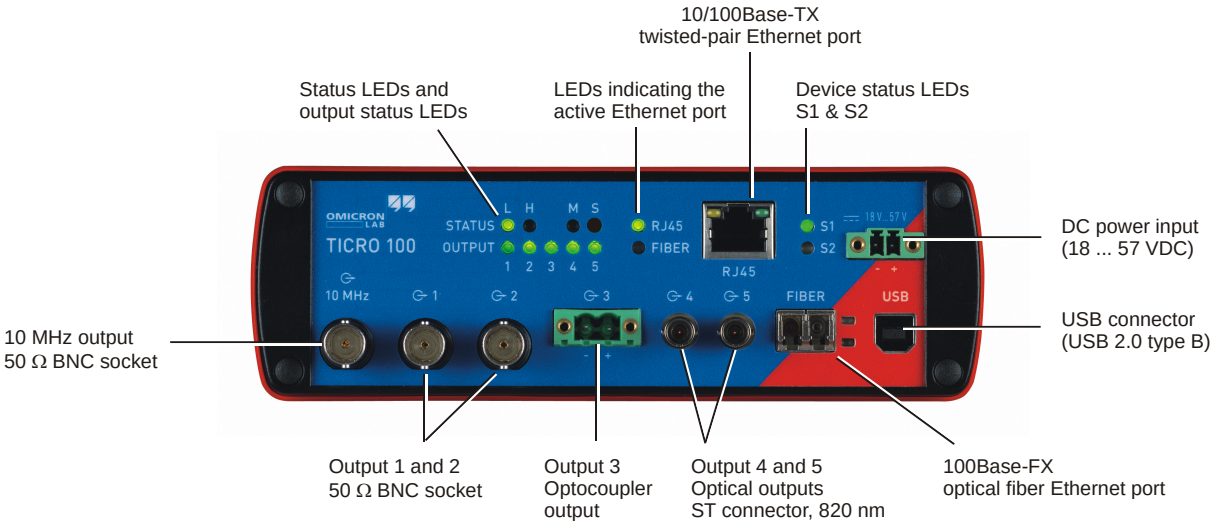
2 Scope of delivery, ordering information, accessories

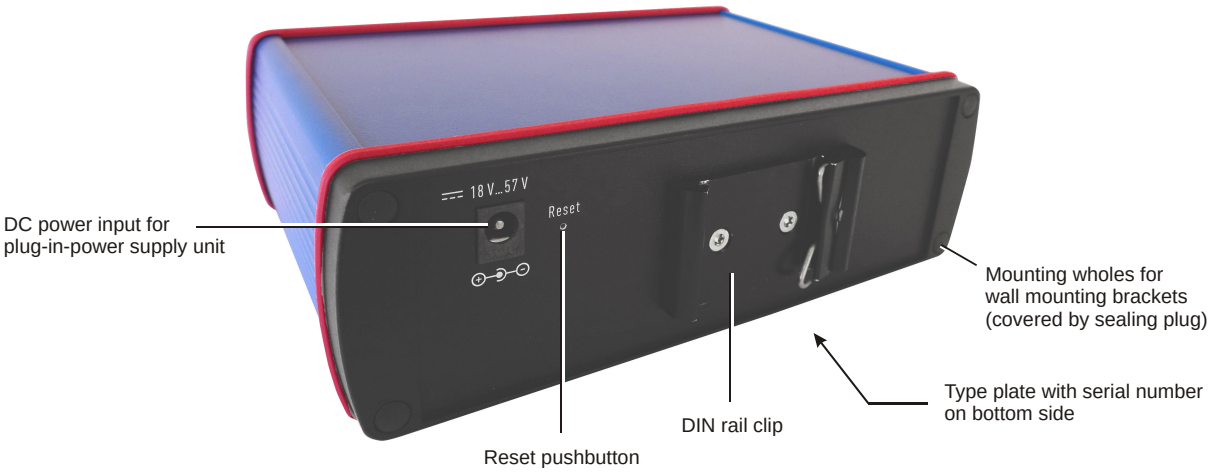
Description	Part No.	Figure
TICRO 100 PTP TimeConverter. The delivered box includes: • 1 *TICRO 100* device	OL000310 for *TICRO 100* with OCXO-100 option OL000311 for *TICRO 100* with OCXO-25 option	
• 1 plug-in power supply unit		
• 1 power connector MC 1.5/2-STF-3.81 (two-pin power connector for external DC power supply)		
• 1 terminal block for optocoupler output MSTB 2,5 HC/ 2-STF-5,08		

• 1 DIN rail mounting clip (Hutsclip/AL/0009) for mounting on 35 mm DIN rail according to IEC 50022 incl. 2 M3x12 screws (TX10)		
• 1 Wall mounting kit AB-WL 3		
• 1 TICRO 100 Quick Start Guide (printed)		
• 1 CD ROM containing the OMICRON *Device Link* software and the PDF versions of the *TICRO 100* Series User Manual and the *TICRO 100* Series Quick Start Guide		

3 Device description

3.1 Device overview





TICRO 100 does not provide an ON/OFF switch! The device automatically powers up after supply voltage is provided via one of the DC power inputs or via Ethernet (PoE).

Refer to the following subsections for detailed information about the LEDs, connectors and operating elements of *TICRO 100*.

3.2 LEDs on the front side

<table>
<tr><th>LED</th><th colspan="3">Description</th></tr>
<tr><td rowspan="10">S1 and S2</td><td colspan="3">Green and red LED indicating the general device status according to the following code.</td></tr>
<tr><td><u>S1 (green)</u></td><td><u>S2 (red)</u></td><td><u>Meaning</u></td></tr>
<tr><td>off</td><td>off</td><td>TICRO 100 not is supplied with power or device reboot is requested.</td></tr>
<tr><td>off</td><td>on</td><td>Device is booting (normal boot process after applying supply voltage or after reboot).</td></tr>
<tr><td>on</td><td>off</td><td>TICRO 100 is ready for operation (boot process finished and device is operational). Observe the other LEDs for information about the PTP clock status, the status of the Ethernet connection and the output states.</td></tr>
<tr><td>on</td><td>on</td><td>Device is booting in recovery mode. Intermediate state when initiating a factory reset (see Operating Procedures Performed Directly on the Device on page 34).</td></tr>
<tr><td>blinking</td><td>off</td><td>Device is in recovery mode, waiting for new software. In the recovery mode, the device provides only a rudimentary Web Interface just allowing for the upload of a software image.</td></tr>
<tr><td>off</td><td>blinking</td><td>Software update is in progress.

NOTICE
Equipment damage possible.
► Do not disconnect TICRO 100 from the power supply or from the Ethernet or USB connection during a software update.</td></tr>
<tr><td>blinking</td><td>blinking</td><td>Hardware error.</td></tr>
<tr><td>RJ45 and FIBER</td><td colspan="3">Green LEDs to indicate the currently active Ethernet port:
RJ45 for 10/100Base-TX (twisted-pair) or FIBER for 100Base-FX (optical fiber).

  Only one Ethernet port can be used at a time. The Ethernet port actually used has to be selected in the Web Interface (see section Network Configuration Page on page 68).</td></tr>
<tr><td>LEDs on the Ethernet connectors</td><td colspan="3">The green LED indicates the Ethernet connection status (link status). The yellow LED indicates that data traffic is active on the interface.</td></tr>
</table>

LED	Description
Status L and H	Green LEDs to indicate the PTP status of the device: **L**: Indicates the Locked state. *TICRO 100* receives PTP time information from a PTP grandmaster clock and is locked to this signal. It is able to provide its defined accuracy. *TICRO 100* is synchronized to the received PTP time signal. The LED starts blinking as soon as *TICRO 100* has established connection to a PTP grandmaster clock and started its locking algorithm. As soon as an accuracy of better than 1 µs is reached, the LED stops blinking. The typical overall accuracy (better than 200 ns) is reached after approximately 30 seconds (with heated internal oscillator (OCXO), see note below). However, please note that the absolute overall system accuracy depends on the accuracy of the PTP grandmaster clock and the PTP compliance of the network infrastructure.  *TICRO 100* is equipped with an oven-controlled oscillator (OCXO). To ensure precise time synchronization, *TICRO 100* will only lock to the PTP time signal after an initial heat-up phase for the OCXO. The duration of this heat-up phase depends on the ambient temperature and is typically 5 - 7 minutes. **H**: Indicates the Hold-over state. If *TICRO 100* was in the Locked state before, it enters the Hold-over state if synchronization to the PTP time signal gets lost. If configured in the output configuration (see page 57), *TICRO 100* continues to output time signals during the Hold-over state. However, synchronization of these output signals is then performed using the internal oscillator (OCXO) instead of the PTP time signal. The maximum hold-over duration depends on the time *TICRO 100* was in the Locked state before: • Locked state ≤ 1 h: Hold-over time = 1 min ("mini hold-over"). • Locked state > 1 h **and** operating time (uptime) > 2 h: Hold-over time = half the operating time. • Locked state > 1 h **and** operating time > 48 h: Max. hold-over time = 24 h. The "unconsumed" hold-over time remaining on the return to the Locked state ist kept and extended by the "locked" duration as stated above.
Status M and S	**M**: LED for future use. Currently without function. **S**: Indicates that *TICRO 100* receives a PTP signal, is connected to a PTP grandmaster, and has taken over the role of a slave clock.
Output 1 to 5	Green LEDs to indicate which outputs are currently active. Outputs can be disabled or muted in the Web Interface or automatically deactivated by *TICRO 100* if it is not able to provide time signals with sufficient accuracy. For more detailed information, please refer to section Output configuration page on page 57.

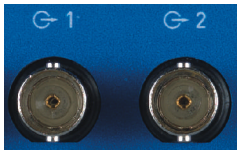
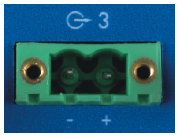
3.3 Connectors on the front side

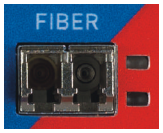
WARNING

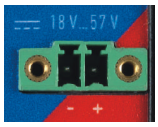
Death or severe injury caused by high voltages possible.

All inputs and outputs of *TICRO 100* are electrically connected to the SELV (safety extra low voltage) insulation group of the device.

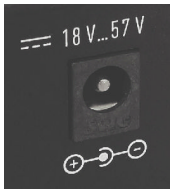
► Do not connect any voltages that are not SELV compliant.

Connector	Description
	10 MHz output (50 Ω BNC socket). This output provides a highly accuracte 10 MHz sine wave signal (4 dBm ± 2 dB at 50 Ω). The 10 MHz output is always active and cannot be configured in the Web Interface.
	Output 1 and 2 (50 Ω BNC socket). Outputs 1 and 2 can be configured in the Web Interface for the following signals: - IRIG-B, unmodulated TTL signal or modulated on 1 kHz carrier - PPX (TTL signal, adjustable number of pulses, for example, 1 PPS or 1 kHz) - DCF77 unmodulated TTL signal - Trigger (TTL signal, 1 pulse at a defined point in time) - Trigger (TTL signal, PPX sequence starting at the defined point in time) For information about configuring these outputs, please refer to section Output configuration page on page 57.
	Output 3 (optocoupler output 30 V/100 mA max., terminal block supplied on delivery). Output 3 can be configured in the Web Interface for the following signals: - IRIG-B unmodulated - PPX (adjustable number of pulses, for example, 1 PPS or 1 kHz) - DCF77 unmodulated - Trigger (1 pulse at a defined point in time) - Trigger (PPX sequence starting at the defined point in time) For information about configuring this output, please refer to section Output configuration page on page 57.

Connector	Description
	Optical output 4 and 5 (ST connector, 820 nm). Outputs 4 and 5 can be configured in the Web Interface for the following signals: - IRIG-B unmodulated - PPX (adjustable number of pulses, for example, 1 PPS or 1 kHz) - DCF77 unmodulated - Trigger (1 pulse at a defined point in time) - Trigger (PPX sequence starting at the defined point in time) For information about configuring these outputs, please refer to section Output configuration page on page 57.
 	**RJ45**: 10/100Base-TX twisted-pair Ethernet port (RJ45 socket). **FIBER**: 100Base-FX optical fiber Ethernet port (ST connector, 820 nm). The LEDs indicate the link status and data traffic. *TICRO 100* can use only one Ethernet port at a time.  If no Ethernet port is selected in the Web Interface, the RJ45 Ethernet port is the default port if *TICRO 100* does not detect an operating Ethernet network on any of the network ports during the first power-up or after a factory reset. It is strongly recommended to set the network port in the Web Interface manually during commissioning (see section Network configuration page on page 68).
	USB port (USB 2.0, type B). Use this interface as an alternative for connecting a computer to *TICRO 100* (instead of accessing *TICRO 100* via Ethernet). Access via the USB port can be disabled in the security configuration (see **Access Restrictions** tab in Security configuration page on page 73).  When accessing the *TICRO 100* Web Interface via the USB port, you should take care that the computer is **not** connected to the Ethernet network *TICRO 100* is connected to. The computer must not be connected to *TICRO 100* over the Ethernet network and the USB port at the same time!

Connector	Description
	DC power input socket (MC 1.5/2-STF-3.81, connector supplied on delivery). The correct polarity is printed on the front plate. You can use this connector to connect a 18 ... 57 VDC supply voltage, either as an alternative to the plug-in power supply unit supplied on delivery (DC power input socket on rear side), or in addition to the plug-in power supply unit to provide power supply redundancy for *TICRO 100*. For more details, please refer to chapter Power Supply on page 22. **WARNING**  **Death or severe injury caused by high voltages possible.** ► Use a power supply unit that complies with the SELV standard if product safety according to IEC 61010-1 and IEC 60255-27 is required. The plug-in power supply unit supplied on delivery complies with the SELV standard. **NOTICE** **Equipment damage possible.** The DC power inputs of *TICRO 100* are protected against polarity reversal if only one input is used at a time. ► When using both DC power inputs, make sure to observe the correct polarity for both inputs. Reversed polarity on one of the DC power inputs would make the reverse polarity protection ineffective and could damage *TICRO 100*.

3.4 Connectors and operating elements on the rear side

Element	Description
	The reset pushbutton can be accessed through the hole in the rear panel using a thin pointed object like the wire of a resistor with a diameter < 0.9 mm, for example. The reset pushbutton can be used to: • Initiate a device reboot. • Initiate a factory reset to reset the device configuration to the factory defaults (for example, if you forgot your password). Please refer to section Operating procedures performed directly on the device on page 34 for more detailed descriptions.
	DC power input socket (standard DC barrel jack 2.5 x 5.5 x 11 mm, center pin positive). Permitted voltage range: 18 ... 57 VDC Use this input to connect the plug-in power supply unit supplied on delivery if *TICRO 100* is not supplied via Power over Ethernet (PoE). You can also use the DC power input on the front side as a second DC source in addition to this DC power input to provide power supply redundancy for *TICRO 100*. For more details, please refer to chapter Power supply on page 22. **WARNING**  **Death or severe injury caused by high voltages possible.** ► Use a power supply unit that complies with the SELV standard if product safety according to IEC 61010-1 and IEC 60255-27 is required. The plug-in power supply unit supplied on delivery complies with the SELV standard. **NOTICE** **Equipment damage caused by overvoltage possible.** This DC power input socket does not fulfill the surge requirements of IEC 60255-27. ► Use the DC power input socket on the front side if IEC 60255-27 compliance is required. **NOTICE** **Equipment damage possible.** The DC power inputs of *TICRO 100* are protected against polarity reversal if only one input is used at a time. ► When using both DC power inputs, make sure to observe the correct polarity for both inputs. Reversed polarity on one of the DC power inputs would make the reverse polarity protection ineffective and could damage *TICRO 100*.

4 Mounting

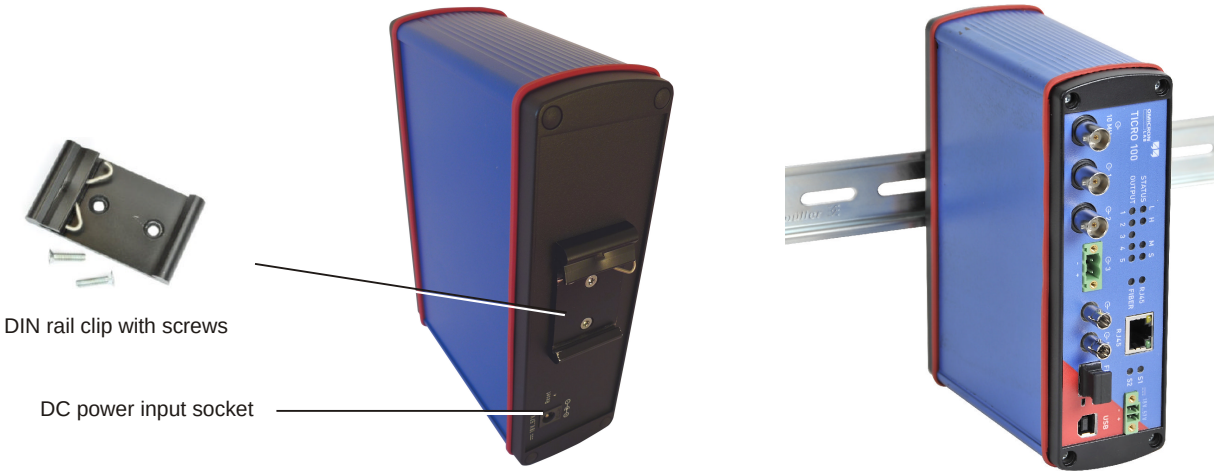
4.1 DIN rail mounting

Proceed as follows to mount *TICRO 100* to a 35 mm DIN rail (acc. to EN 50022):

1. Place the DIN rail clip supplied on delivery to the rear side of *TICRO 100* as shown in the figure below and align it with the mounting holes. The spring side of the DIN rail clip must point towards the DC power input socket!
2. Use the two M3x12 screws to fasten the DIN rail clip to *TICRO 100* (TX10 screwdriver required). Do not use other screws than delivered with the DIN rail clip!
3. Hook the spring side of the DIN rail clip to the top side of the DIN rail.
4. Press the device downwards and then towards the DIN rail until the clip audibly snaps onto the DIN rail.

Proceed as follows to remove *TICRO 100* from the DIN rail:

1. Compress the spring of the DIN rail clip by pressing *TICRO 100* downwards.
2. Release the bottom side of the clip from the DIN rail and withdraw *TICRO 100* upwards.

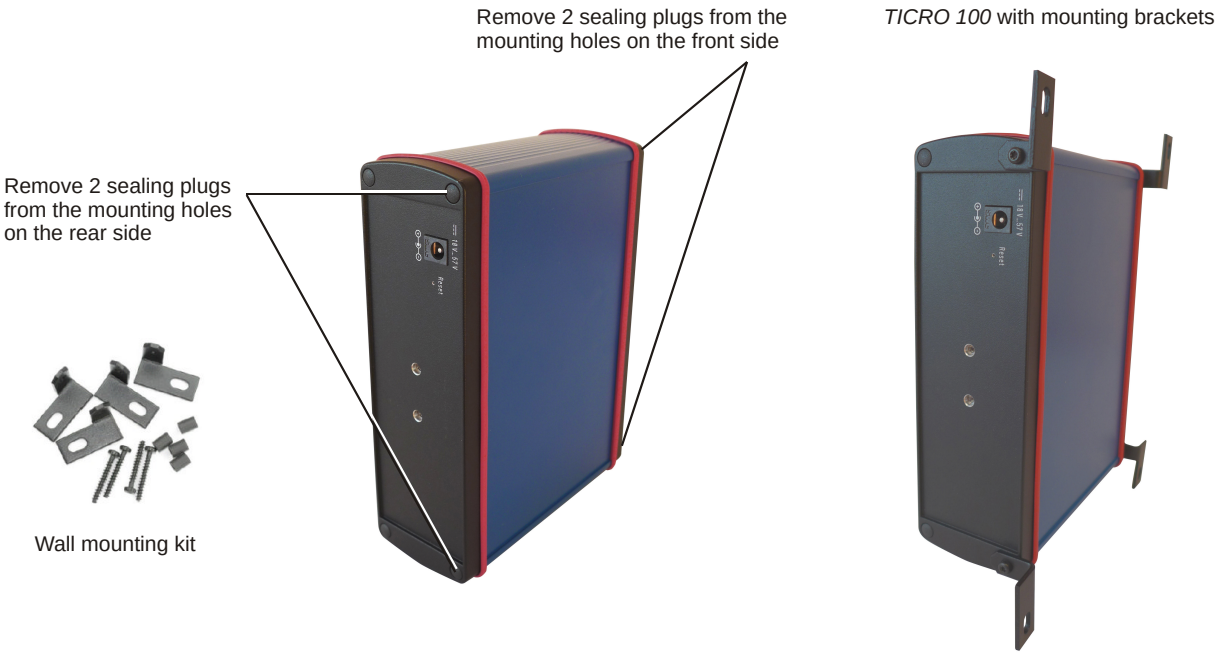


4.2 Wall mounting

A wall mounting kit with four mounting brackets is provided on delivery for mounting *TICRO 100* on flat surfaces, for example on a wall.

Please observe the instructions included in the wall mounting kit for attaching the mounting brackets to *TICRO 100*. Proceed as follows:

1. At the desired mounting positions for the mounting brackets, remove two sealing plugs on the rear side and two sealing plugs on the front side of *TICRO 100*.
2. Unscrew the four uncovered screws from *TICRO 100*.
3. Insert the four sealing rings included in the mounting kit to the mounting holes of *TICRO 100*.
4. Fasten the mounting brackets using the delivered 22 mm long screws as shown below.
5. Mount *TICRO 100* to the wall.



5 Power supply

TICRO 100 does not provide an ON/OFF switch! The device automatically powers up after supply voltage is applied.

There are three possibilities to supply *TICRO 100* with power:

1. Power supply via Power over Ethernet (PoE).
2. Power supply via the plug-in power supply unit provided on delivery.
3. Power supply via any suitable external DC supply voltage.

You can supply *TICRO 100* using only one of these power supply options or using a combination of two or all three options to provide power supply redundancy. When supplied by two external power supplies (options 2. and 3. above), *TICRO 100* automatically switches to the other source without any interruption if one power source fails. If supplied via PoE and an external power supply (option 1. and 2. or option 1. and 3.), *TICRO 100* will reboot after switching from the external power supply (option 2. or 3.) to PoE power supply (option 1.).

NOTICE

Equipment damage possible.

The DC power inputs of *TICRO 100* are protected against polarity reversal if only one input is used at a time.

► When using both DC power inputs, make sure to observe the correct polarity for both inputs. Reversed polarity on one of the DC power inputs would make the reverse polarity protection ineffective and could damage *TICRO 100*.

If powered via the delivered plug-in power supply unit or by an external DC supply voltage, *TICRO 100* is able to operate as a power sourcing equipment (PSE) for class 1 devices according to IEEE 802.3af.

5.1 Power supply via Power over Ethernet

The easiest method for supplying *TICRO 100* with power is via Power over Ethernet (PoE) according to IEEE 802.3af. Power supply via PoE does not require any additional cabling since it uses the same cable (RJ45 port) for Ethernet communication and power supply.

Power supply via PoE is not possible if you are using an optical fiber Ethernet network.

The Ethernet network port used to supply *TICRO 100* (i.e., the network port *TICRO 100* is connected to) must be able to supply a class 3 powered device (power consumption < 13 W).

If no suitable PoE source (e.g., an Ethernet switch) is available, it is also possible to insert a suitable PoE injector between the Ethernet port on the network side and the Ethernet port of *TICRO 100*. A PoE injector is not included in the scope of delivery.

5.2 Power supply via the delivered plug-in power supply unit

Connect the plug-in power supply unit provided on delivery to the DC power input socket (standard DC barrel connector) on the rear side of *TICRO 100*.

When connecting another power supply unit than the delivered one to this DC power input socket, please observe the correct polarity (center pin is positive). The used power supply unit must deliver a voltage of 18 ... 57 VDC with an output power of at least 13 W.

WARNING

Death or severe injury caused by high voltages possible.

► Use a power supply unit that complies with the SELV standard if product safety according to IEC 61010-1 and IEC 60255-27 is required. The plug-in power supply unit supplied on delivery complies with the SELV standard.

NOTICE

Equipment damage caused by overvoltage possible.

The DC power input socket on the rear side does not fulfill the surge requirements of IEC 60255-27.

► Use the DC power input socket on the front side if IEC 60255-27 compliance is required.

5.3 Power supply via an external DC supply voltage

TICRO 100 can also be supplied by an external DC supply voltage using the DC power input socket on the front side. A corresponding two-pin connector (MC 1.5/2-STF-3.81) is provided on delivery. The correct polarity is printed on the front plate.

The DC supply voltage must be in a range of 18 ... 57 V and deliver a power of at least 13 W.

WARNING

Death or severe injury caused by high voltages possible.

► Use a power supply unit that complies with the SELV standard if product safety according to IEC 61010-1 and IEC 60255-27 is required. The plug-in power supply unit supplied on delivery complies with the SELV standard.

5.4 Using TICRO 100 as a PoE power source according to IEEE 802.3af

If powered via the delivered plug-in power supply unit or by an external DC supply voltage as described in the sections above, *TICRO 100* is able to operate as a power sourcing equipment (PSE) according to IEEE 802.3af. The device is then able to power a class 1 device via its 100BaseTX Ethernet port. This becomes especially handy if you operate *TICRO 100* with the antenna-integrated PTP grandmaster clock *OTMC 100* from OMICRON Lab.

6 Accessing the Web Interface & initial setup

TICRO 100 automatically powers up after supply voltage is applied. The green LED S1 lights up and the red LED S2 is off when the device is ready for operation.

TICRO 100 can be configured and controlled completely via the Web Interface using a computer. Under normal circumstances, no manual intervention at the device itself will be required.

6.1 System requirements

Your computer must fulfill the following requirements to access the *TICRO 100* Web Interface:

- OMICRON *Device Link* installed (see chapter OMICRON Device Link on page 83).

  OMICRON *Device Link* is always required for the initial access to *TICRO 100*. If a static IP address is assigned to *TICRO 100*, the device can be accessed any time and from any computer using this IP address.

- Web browser installed (Microsoft Edge, Mozilla Firefox 20 or higher, or Google Chrome version 31 or higher).
- For access via Ethernet network only:
  Network port configured for operation in the network *TICRO 100* is connected to.
- For access via USB only:
  USB 2.0 port available. While accessing *TICRO 100* via USB, the computer must not be connected to the same Ethernet network *TICRO 100* is connected to!

If you are accessing *TICRO 100* from a Mac or Linux operating system supporting zeroconf, you can access the Web Interface of *TICRO 100* by entering **http://<hostname>.local** to the address bar of your web browser. The default hostname is the device serial number. The serial number is available on the type plate on the bottom side of *TICRO 100* (labeled "SerNo").

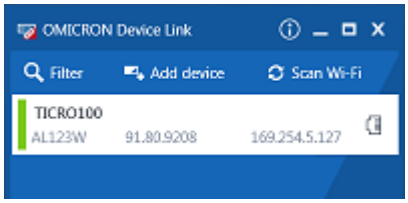
6.2 Accessing the TICRO 100 Web Interface

OMICRON *Device Link* is required for initial access to *TICRO 100*. If you know the IP address of *TICRO 100*, it is alternatively also possible to access the device from a web browser using its IP address (without using OMICRON *Device Link*).

Proceed as follows to access the *TICRO 100* Web Interface using OMICRON *Device Link*:

1. Connect your computer to the network or to the USB port of *TICRO 100*.
   (Please note: Access via the USB port may possibly be disabled in the *TICRO 100* configuration (see **Access Restrictions** tab in **Security** configuration page on page 73)).
2. Supply your *TICRO 100* with power (see Power supply on page 22).
3. If your computer is not connected via the USB port of *TICRO 100*: Connect your *TICRO 100* to the network your computer is connected to.

4. If necessary, install OMICRON *Device Link* on your computer. See chapter OMICRON Device Link on page 83.
5. Launch OMICRON *Device Link*.
6. OMICRON *Device Link* will automatically find and display your *TICRO 100*.



The vertical bar on the left displays the device status:

- Green bar: The device is online and ready for operation.
- Gray bar: The device is offline. Supply your *TICRO 100* with power.
- Red bar: The device is online but not accessible due to incorrect IP configuration.

TICRO 100 is usually configured to obtain the IP address automatically. However, it is also possible to assign a static IP address to *TICRO 100*. In this case, the following behavior applies: When accessing *TICRO 100* via Ethernet, OMICRON *Device Link* will find the *TICRO 100*, but display a red bar to indicate that the device cannot be accessed.

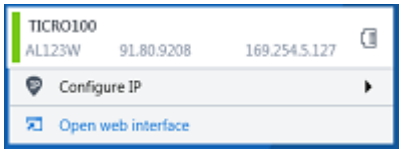
► Click the *TICRO 100* entry and select **Configure IP**.

OMICRON *Device Link* will then display an IP configuration page. In this page, select **Use the following IP address** and enter the IP address of your *TICRO 100*, or enter an IP address of your choice to assign a new IP adress to your *TICRO 100*. Click the **Subnet mask** field to automatically fill a subnet mask and then click **Apply** to connect to *TICRO 100*.

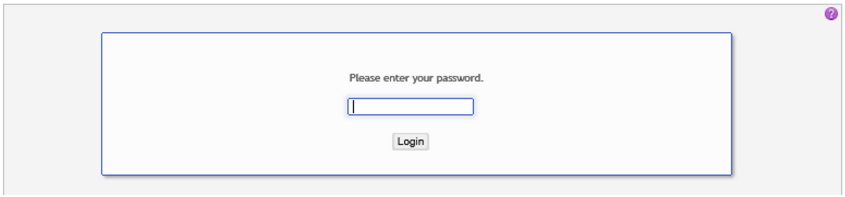
Or

► Click the **Add device** button and enter the IP address assigned to *TICRO 100*.

7. A green vertical bar indicates that OMICRON *Device Link* successfully connected to your *TICRO 100*. Click the *TICRO 100* entry and select **Open Web Interface**.



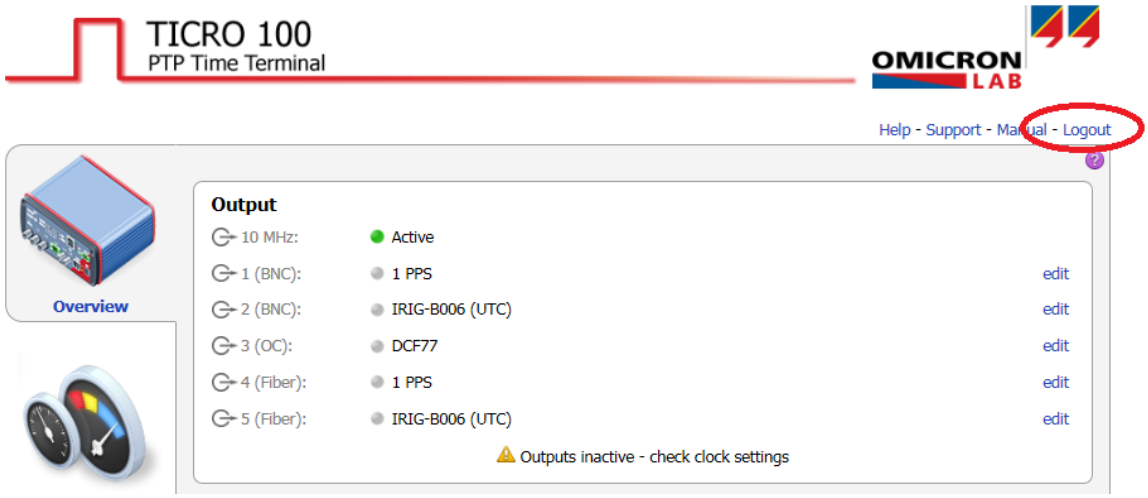
8. The Web Interface is opened in a web browser.
Password protection is disabled by default. If password protection is configured for *TICRO 100*, a login dialog is displayed. Enter your password and click **Login**. The default password is *timeterminal*.



9. The start page of the *TICRO 100* Web Interface is displayed. You can now access all pages of the Web Interface.

   ► Proceed with section Next steps to set up TICRO 100 on page 27 to configure *TICRO 100* according to your needs.

   ► Use the **Logout** link in the top right corner to exit the *TICRO 100* Web Interface (only available if password protection is enabled).



6.3 Next steps to set up TICRO 100

After connecting *TICRO 100* to the network and accessing the device from your computer, you have to configure your *TICRO 100* according to your needs.

See chapter The TICRO 100 Web Interface on page 36 or the *TICRO 100* help for a detailed description of the Web Interface, or section Operating procedures performed via the Web Interface on page 29 for a description of the most important operating procedures.

Proceed as follows to set up and configure your *TICRO 100*. Consult your network administrator if you do not know the correct settings.

1. Configure the network settings.
   Open the **Configuration** section of the Web Interface and display the **Network** page (see page 68). Select your configuration and click the **Save** button to save and apply your settings.

   ► Select the network interface and configure the network/IP settings according to the needs of your network.

   By default, *TICRO 100* will attempt to get an IPv4 address via DHCP and assign an IPv6 address using the automatic configuration. If no DHCP server is available for IPv4, *TICRO 100* uses the zeroconf service to automatically assign an own IP address.

2. Configure the PTP settings.
   Display the **PTP** page of the **Configuration** section (see page 64). Select your configuration and click the **Save** button to save and apply your settings. The most important PTP settings are:

   a. **PTP profile** (**General** tab):

      ► Select the PTP profile used in your network (Default E2E, Default P2P, Power profile acc. to IEEE C37.238-2011, Power profile acc. to IEEE C37.238-2017, or Power Utility profile acc. to IEC 61850-9-3).

      ► Select the maximum permitted inaccuracy of the PTP grandmaster. *TICRO 100* enters the Hold-over state if the inaccuracy of the actual PTP grandmaster exceeds this value.

   b. **Domain number** (**Default** tab): All PTP devices that should synchronize to the same grandmaster clock must use the same domain number.

3. Configure the output settings.
   Display the **Output** page of the **Configuration** section (see page 57). Select your configuration and click the **Save** button to save and apply your settings.

   ► Configure the outputs according to your needs. A separate tab is available for each output.

   ► In the **Outputs active** field of the **Clock settings** pane you can configure *TICRO 100* to automatically deactivate its outputs if it is not able to provide time signals with sufficient accuracy. The outputs can be always active, only active when *TICRO 100* is locked to a PTP signal, or only active when *TICRO 100* is locked to a PTP signal or in the Hold-over state.

   ► Use the **Current time zone** field of the **Clock settings** pane to set the time zone of the location where you are using *TICRO 100*.

4. If desired, secure your *TICRO 100* against unauthorized access.
   Display the **Security** page of the **Configuration** section (see page 73). Select your configuration and click the **Save** button to save and apply your settings.

   a. Display the **Access Control** tab and set the **Access** field to "Password" or "Read-Only".

      The default password *timeterminal* is used if you set the **Access** field to "Password" or "Read-Only" without defining a password.

   b. Enter a password to the **Change Password** field and repeat your password in the **Confirm Password** field. Click the **Change** button to save and apply your settings. From now on, entering the password is required to access *TICRO 100*.

   c. In the **Protocol** field, select whether you want to allow access via the secure HTTPS protocol only or via HTTPS and the unsecure HTTP protocol.
      By default, password transmission to *TICRO 100* is performed unencrypted. By selecting **HTTPS only** you can force the use of the encrypted HTTPS protocol and thus protect your password.

      When accessing *TICRO 100* via HTTPS, an "untrusted connection" message may appear because *TICRO 100* does not have a valid certificate. To avoid such messages, it is necessary to provide *TICRO 100* with such a certificate. Please refer to subsection "Generate certificate tab" in section Security configuration page on page 73 for more detailed information.

   d. In the **Services** field, select whether you want to allow access to *TICRO 100* via the Web Interface (**Web**) or the Application Programming Interface API (**SOAP**) only or via both interfaces (**Web and SOAP**).

   e. **Protocol restrictions**: Disabling services that are not required or used for operation will minimize potential points of attack and thus make *TICRO 100* safer.

      ► Usually OMICRON *Device Link* is used to find *TICRO 100* in the network. However, OMICRON *Device Browser*, the predecessor of *Device Link* may also be used to find *TICRO 100* and to change its network configuration. To protect your *TICRO 100* against unauthorized or unintentional configuration changes using OMICRON *Device Link* or OMICRON *Device Browser*, deselect the **Allow OMFIND network configuration** option.

      ► If you want to prohibit standard user/password authenticated access to *TICRO 100* via secure shell (SSH), deselect the **Allow SSH password login** option. When deselected, access via SSH is only possible via key based authentication. This reduces the risk of unauthorized access to *TICRO 100* through brute force attacks.

      The options in the **Protocol Restrictions** tab of the **Security** page just enable or disable protocol options. In order to completely disable a service, use the **Services** pane of the **Network** configuration page.

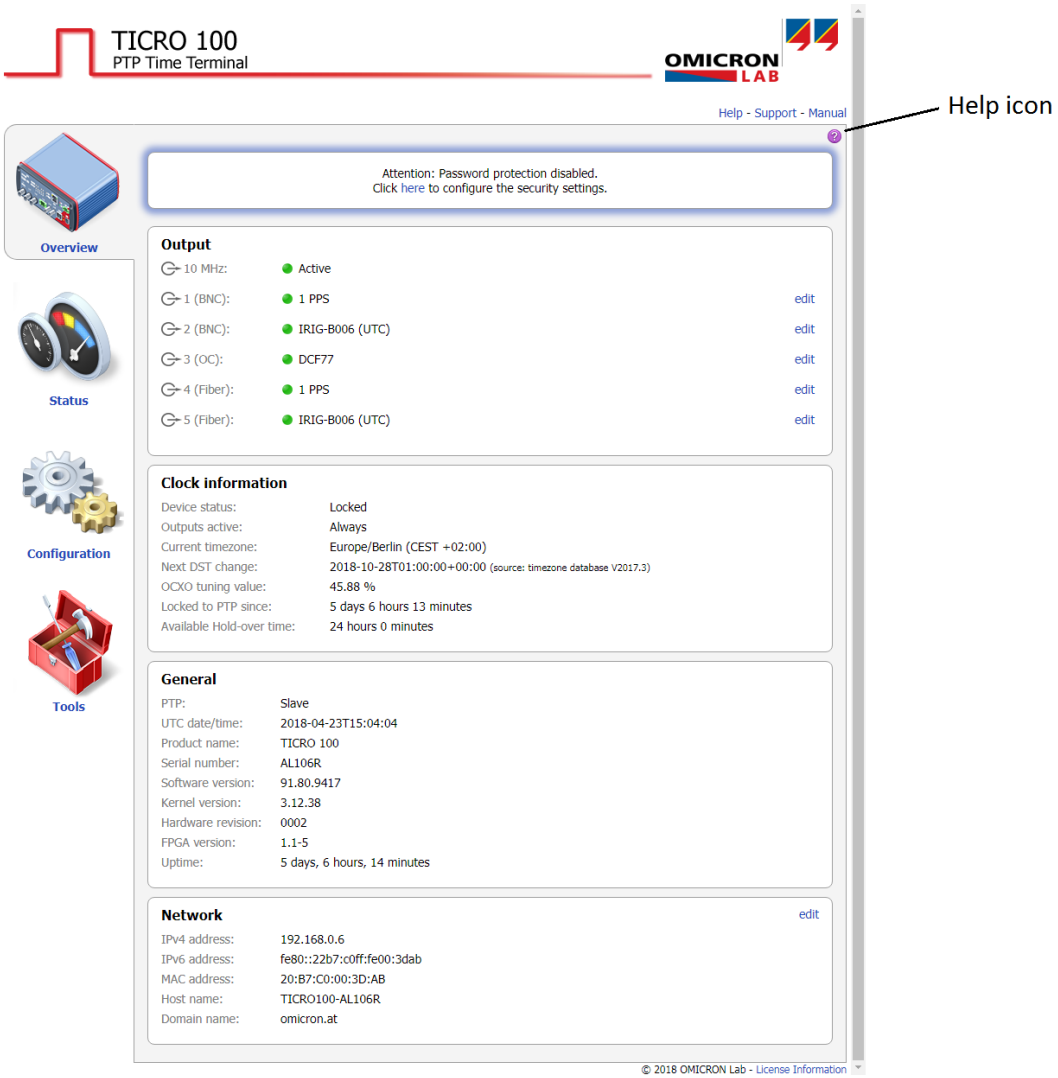
7 Operating TICRO 100

The following sections describe the most important operating procedures for *TICRO 100*.

Please refer to chapter The TICRO 100 Web Interface on page 36 or the Web Interface help for a detailed description of the Web Interface.

7.1 Operating procedures performed via the Web Interface

The following subsections describe the most important operating procedures that can be performed via the Web Interface using a computer. In order to operate *TICRO 100* via the Web Interface, access the device from a computer as described in section Accessing the TICRO 100 Web Interface on page 24.



7.1.1 Displaying status information

1. The overall status information (output states, general device status and network status) are displayed in the **Overview** section of the Web Interface.
2. To display more detailed status information, access the **Status** section by clicking the corresponding icon in the navigation bar of the Web Interface.
3. Click the **Output**, **PTP** or **Network** icon of the **Status** section to display the corresponding status page (see page 42).

7.1.2 Configuring the outputs

A short overview of the output states is provided in the **Overview** section of the Web Interface. The overview also provides hyperlinks to directly access the output configuration. The 10 MHz output is always active and cannot be configured in the Web Interface.

Please refer to section Output configuration page on page 57 for detailed information about the possible output signal modes.

1. Click the **Configuration** icon in the navigation bar of the Web Interface.
2. Click the **Output** icon of the **Configuration** section and display the tab of the output to be configured.
3. Configure the output(s) according to your needs.
4. Use the **Outputs active** field in the **Clock Settings** pane to select whether *TICRO 100* should automatically deactivate its outputs if it is not able to provide time signals with sufficient accuracy. The outputs can be always active, only active when *TICRO 100* is locked to a PTP signal, or only active when *TICRO 100* is locked to a PTP signal or in the Hold-over state.
5. Use the **Current time zone** field of the **Clock settings** pane to set the time zone of the location where you are using *TICRO 100*.
6. Click the **Save** button to save and apply your output configuration to *TICRO 100*.

7.1.3 Defining a password

If no password is defined for accessing *TICRO 100*, a corresponding note is displayed on the **Overview** page providing the possibility to directly access the security configuration (see page 73) in order to enable password protection.

1. Click the **Configuration** icon in the navigation bar of the Web Interface.
2. Click the **Security** icon of the **Configuration** section and display the **Access Control** tab.
3. Enter your password to the **Change password** field and repeat it in the **Confirm password** field.

The password is case sensitive and must have at least 5 characters (letters, figures or special characters).

4. In the **Access** field, select **Password** to activate password protection.

If you set the **Access** field to **Password** without defining a password, the default password *timeterminal* is used.

5. In the **Protocol** field, select whether you want to allow access via the secure HTTPS protocol only or via HTTPS and the unsecure HTTP protocol.
   By default, password transmission to *TICRO 100* is performed unencrypted. By selecting **HTTPS only** you can force the use of the encrypted HTTPS protocol and thus protect your password.
6. In the **Services** field, select whether you want to allow access to *TICRO 100* via the Web Interface (**Web**) or the Application Programming Interface API (**SOAP**) only or via both interfaces.
7. Click the **Save** button.
8. Your new password is applied to *TICRO 100* and the login dialog appears.

For more information, please refer to section Security configuration page on page 73.

Perform a factory reset on the device if you forgot your password (see section Operating procedures performed on the device on page 34).

7.1.4 Setting the time manually

Setting the time manually is only required and possible if *TICRO 100* does not receive time with sufficient accuracy via PTP. The manual time settings are overwritten by the PTP time information as soon as *TICRO 100* locks to a PTP signal.

Please refer to section Device Control page on page 78 for more detailed information about leap seconds and time setting.

1. Click the **Tools** icon in the navigation bar of the Web Interface.
2. Click the **Device Control** icon.
3. Click the **New Time (UTC)** field to open a calendar dialog allowing for the selection of the current date and time.
4. Use the **New UTC-TAI offset** field to specify the actual offset of TAI to UTC (in 2017: 37 seconds; if necessary, investigate on the Internet for the actual TAI-UTC offset valid at the time of reading).

   If *TICRO 100* is locked to a PTP grandmaster, the UTC-TAI offset is updated automatically via PTP.

5. Click the **Save** button to save and apply your time settings to *TICRO 100*.

7.1.5 Running a software update for TICRO 100

1. Click the **Tools** icon in the navigation bar of the Web Interface.
2. Click the **Software Update** icon.
3. Click the **Browse...** button to navigate to the software image file and select it.
4. Deselect the **Keep settings** check box if you want to reset the device configuration to the factory defaults after the software update. When the check box is selected, the user specific configuration settings are kept during the software update.
5. Click the **Update** button to start the software update.

6. The update process may take several minutes. Do not unplug the DC power supply or disconnect the Ethernet connection between *TICRO 100* and the computer during this process.
7. *TICRO 100* automatically restarts after the software update has completed.

If the software update process fails due to any reason, *TICRO 100* enters a recovery mode on the next power-up. In this mode, the device provides only a rudimentary Web Interface (similar to the **Software Update** page) just allowing for the upload of a software image (see section Uploading new software to the device in recovery mode on page 33).

7.1.6 Performing a reboot of TICRO 100

A device reboot can also be performed directly on the device (see section Operating procedures performed on the device on page 34).

1. Click the **Tools** icon in the navigation bar of the Web Interface.
2. Click the **Device Control** icon.
3. Click the **Reboot** button next to **Reboot device**.
4. *TICRO 100* performs a reboot. The device will be ready for operation again after approximately one minute.

7.1.7 Performing a factory reset (reset to factory defaults)

A factory reset can also be performed directly on the device (see section Operating procedures performed on the device on page 34). Performing a factory reset may possibly result in an IP address change of *TICRO 100* due to automatic IP address assignment by a DHCP server.

1. Click the **Tools** icon in the navigation bar of the Web Interface.
2. Click the **Device Control** icon.
3. Click the **Reset** button next to **Factory reset**.
4. *TICRO 100* performs a reboot and resets all configuration settings to the factory defaults. The device will be ready for operation again after approximately one minute.

7.1.8 Creating a system snapshot for troubleshooting

A system snapshot contains the configuration settings and the log file. It thus provides important information for the technical support in case of problems.

1. Click the **Tools** icon in the navigation bar of the Web Interface.
2. Click the **Device Control** icon.
3. Click the **Download** button next to **System snapshot** to download a system snapshot file. Downloading a system snapshot may take approx. 30 s to 1 minute.

7.1.9 Uploading new software to the device in recovery mode

The recovery mode is entered automatically if a software update performed via the Web Interface fails.

1. In recovery mode the device provides a rudimentary Web Interface solely allowing for the upload of a software image.
2. Click the **Browse...** button to navigate to a suitable software image file.
3. Click the **Update** button to start the software update.
4. The update process may take several minutes. Do not unplug the DC power supply or disconnect the Ethernet connection between *TICRO 100* and the computer during this process.
5. *TICRO 100* automatically restarts after the software has installed completely.

7.1.10 Assigning an IP address manually

The IP address of *TICRO 100* is usually assigned automatically. If a DHCP server is available in the network, the IP address is assigned by the DHCP server. If not, *TICRO 100* automatically selects and assigns an IP address on its own.

1. Click the **Configuration** icon in the navigation bar of the Web Interface.
2. Click the **Network** icon of the **Configuration** section and display the **IPv4** tab (or **IPv6** if the network supports IPv6).
3. Select **IPv4 static IP address** in the **Configuration** field.
4. Enter the **IP address**, the **Network mask**, the **Gateway** address and the **Name server** address in dot-decimal notation (e.g.: 192.168.1.100).
5. Click the **Save** button to upload and save your settings in *TICRO 100*.

See also section Network configuration page on page 68.

7.1.11 Viewing and/or exporting the system log file

The log file contains all events logged by the system. Therefore, it may be helpful for the OMICRON Lab Technical Support in case of problems.

Which types of events are actually logged by the system can be selected in the Log & Notifications configuration (see page 71).

1. Click the **Status** icon in the navigation bar of the Web Interface.
2. Click the **Log Viewer** icon to display the log file.
3. View the messages logged in the file. Error messages are displayed in red, warning messages are displayed in orange, notice messages are displayed in black. All other messages are displayed in gray.
4. By clicking **Clear View** you can clear the display of the **Log Viewer** page. This does not clear the log file. Re-opening the **Log Viewer** page will again display all messages logged in the log file.
5. By clicking **Export Log** you can export the log file content to a text file (file extension .log).

The log file is cleared with each reboot of *TICRO 100* (see section Performing a reboot of TICRO 100 on page 32 or Performing a reboot of TICRO 100 on page 34). If the maximum size of the log file is reached, the system automatically deletes old log file entries in order to release memory space for new entries.

7.2 Operating procedures performed directly on the device

This section describes operating procedures that can be performed directly on *TICRO 100* using the reset pushbutton. The reset pushbutton can be accessed through the hole in the rear panel using a thin pointed object like the wire of a resistor with a diameter < 0.9 mm, for example.

7.2.1 Performing a reboot of TICRO 100

A device reboot can also be performed via the Web Interface (see section Performing a reboot of TICRO 100 on page 32).

1. Press the reset pushbutton and release it immediately.
2. The green LED S1 goes off for approx. 1 s.
3. LED S2 lights up red during the boot process.
4. After approx. 15 s, the red LED S2 goes off and the green LED S1 lights up.
5. The device rebooted successfully and is ready for operation again.

7.2.2 Performing a factory reset (reset to factory defaults)

A factory reset can also be performed via the Web Interface (see section Performing a factory reset on page 32).

Performing a factory reset may possibly result in an IP address change of *TICRO 100* due to automatic IP address assignment by a DHCP server.

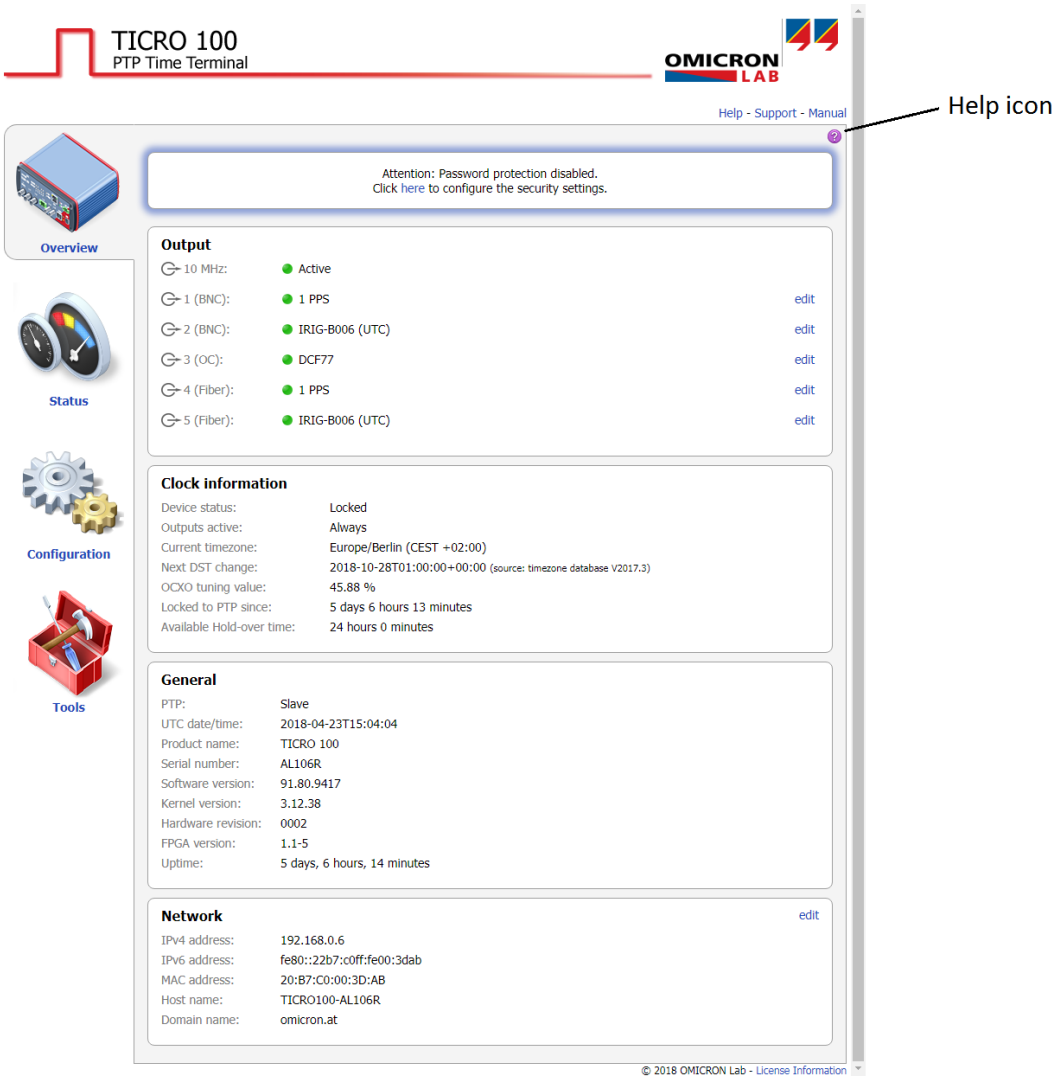
Resetting the device to the factory defaults may be necessary if you forgot your password or if you cannot access the *TICRO 100* Web Interface anymore because you selected the wrong Ethernet network port by mistake before.

1. Press the reset pushbutton and keep it pressed.
2. The green LED S1 goes off.
3. After approx. 5 s, the red LED S2 lights up together with the green LED S1. Keep the button pressed and wait until the green LED S1 goes off (the red LED S2 is still on).
4. Release the reset pushbutton.
5. After approx. 15 s, the red LED S2 goes off and the green LED S1 lights up.
6. The device rebooted successfully and has now the factory default configuration settings.

8 The TICRO 100 Web Interface

The Web Interface is used to access and configure *TICRO 100* with a computer.

Click the help icon in the top right corner of a page to display the specific help topic for this particular page. Click **Help** in the top right corner of the Web Interface to open the start page of the help system for the Web Interface.



Click **Support** in the top right corner to open the contact information page providing OMICRON Lab contact addresses and information how to contact the Technical Support of OMICRON Lab in case of problems.

Click **Manual** in the top right corner to open this manual in PDF format.

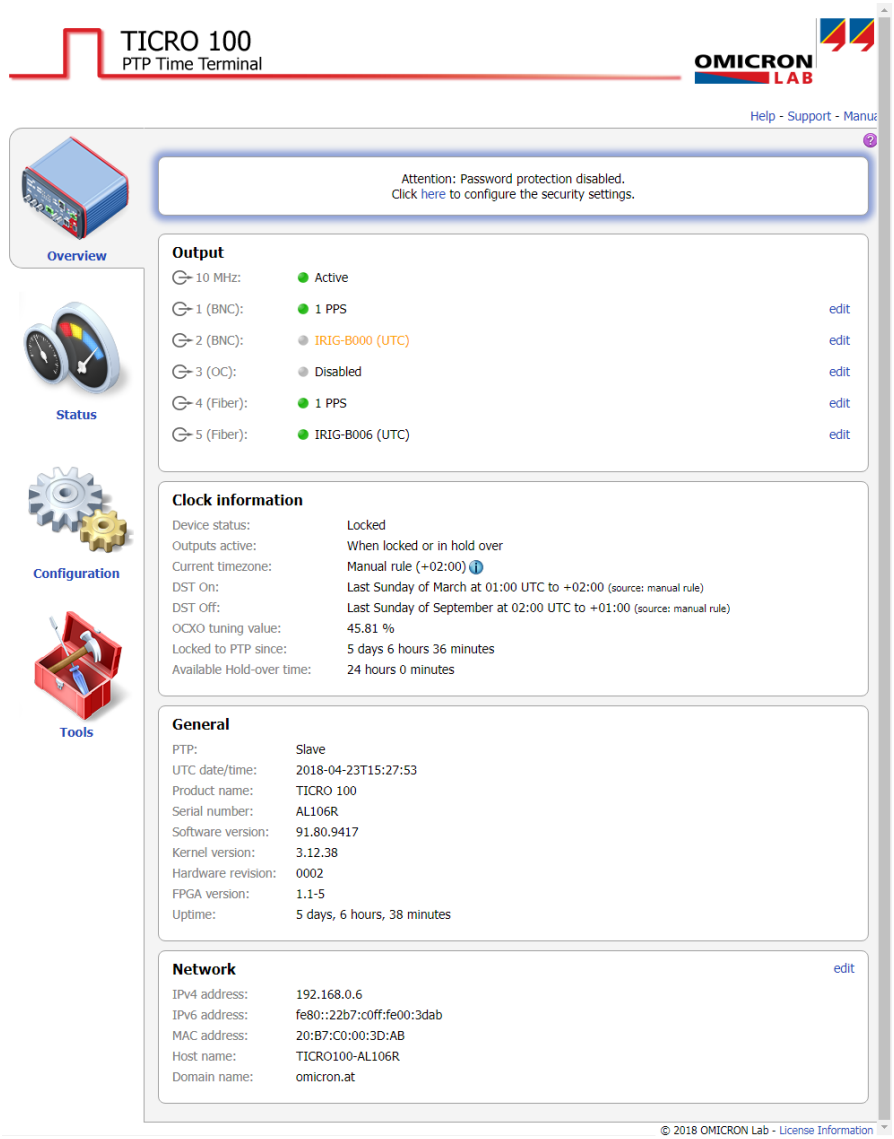
Click **Logout** in the top right corner to exit the *TICRO 100* Web Interface (only available if password protection is enabled).

Click **License Information** in the bottom right corner to view copyright and license information regarding open source products used in the *TICRO 100* software.

The Web Interface is divided into four main sections. Click an icon in the navigation bar on the left to access the content of the corresponding section.

	**Overview** (see page 38) This section provides an overview of the current settings and states of *TICRO 100*.
	**Status** (see page 42) The **Status** section provides detailed information about the current states and settings of the outputs, the PTP status and the network status. An additional **Log Viewer** page shows all events logged in the internal log file.
	**Configuration** (see page 56) Use the **Configuration** section to configure the device settings (outputs, clock, PTP, network and security settings). You can furthermore configure the event logging and the e-mail notification function of *TICRO 100*.
	**Tools** (see page 77) Use this section to perform a software upgrade for *TICRO 100* or to perform a reboot or a factory reset of the device. You can furthermore upload or download the device configuration, or download a system snapshot containing important information for the Technical Support in case of problems.

8.1 Overview section



The **Overview** section provides an overview of the current settings and states of *TICRO 100*. If no password for accessing *TICRO 100* is defined, a corresponding note is displayed providing the possibility to directly access the security configuration (see page 73) in order to enable password protection.

Some elements provide an **edit** hyperlink. Click this hyperlink to directly open the corresponding configuration page (see page 56).

The following information is displayed in the **Overview** section.

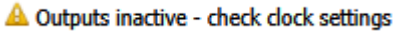
Output pane

Displays the configuration of each output (IRIG-B, PPX, DCF77, etc.) and if the output is active or not:

1 PPS	Green LED: Output active
IRIG-B000	Gray LED, text displayed in orange: Output muted
Disabled	Gray LED, text displayed in black: Output disabled

The 10 MHz BNC output is always active as soon as *TICRO 100* is ready for operation.

If *TICRO 100* is not in the Locked or in the Hold-over state, it possibly deactivates its outputs automatically depending on the configuration of the 'Outputs active' parameter. In this case, the following warning is displayed. For more detailed information, please refer to the 'Outputs active' parameter in the **Output** status page (see page 43) or the **Output** configuration page (see page 57).



Clock information pane

The following is a short description of the parameters displayed in the **Clock information** pane of the **Overview** section. Refer to subsection Clock Information pane of the **Status** section on page 44 for more detailed information.

Device status	Displays the device status of *TICRO 100*: **Initializing**: The boot process of *TICRO 100* is in progress after providing supply voltage to the device or after a device reboot. After the boot process is finished, *TICRO 100* changes to the Locking state if a usable PTP grandmaster clock is available in the network. Otherwise it remains in the Initializing state. **Locking**: *TICRO 100* tries to lock to the PTP time signal. If it is able to lock to the PTP time signal, *TICRO 100* changes to the Locked state. If not, it changes to the Unlocked state. **Locked**: *TICRO 100* receives PTP time information from a PTP grandmaster clock and is locked to this signal. **Hold-over**: If *TICRO 100* was in the Locked state before, it enters the Hold-over state if synchronization to the PTP time signal gets lost. If configured in the output configuration (see page 57), *TICRO 100* continues to output time signals during the Hold-over state. However, synchronization of these output signals is then performed using the internal oscillator (OCXO) instead of the PTP time signal. **Unlocked**: *TICRO 100* could not synchronize to a PTP time signal within 5 minutes after powering-up (or a device reboot), or the Hold-over state elapsed when *TICRO 100* was in the Locked stated before and lost synchronization. **Hardware error**: The device-internal hardware check failed. Reboot *TICRO 100* (see Device Control page on page 78). If the hardware error status still persists after the reboot, send your *TICRO 100* to OMICRON Lab for repair (for contact information, please refer to section Support on page 93).

Outputs active	*TICRO 100* can be configured to automatically deactivate its outputs if it is not able to provide time signals with sufficient accuracy. The behavior of this automatic deactivation is defined in the **Output** configuration page (see page 57). This parameter indicates in which device states the *TICRO 100* outputs are active.
Current timezone	Displays the timezone set for the internal clock in the **Output** configuration page (see page 57) together with the corresponding offset from UTC in brackets.
OCXO tuning value	For new OCXO oscillator components, the OCXO tuning value should be between 10 % and 90 % during the Locked state of *TICRO 100*.
Locked to PTP since	Displays the time *TICRO 100* is in the Locked state. The time is reset with each new locking procedure of *TICRO 100*.
Available hold-over time	Displays the time *TICRO 100* is able operate in the hold-over mode without synchronization to the PTP time signal.

General pane

PTP	Displays the current PTP status of *TICRO 100*. Possible states are: Slave, listening, uncalibrated, faulty and disabled. See the **PTP** status page (see page 47) or the **PTP** configuration page (see page 64) for more information.
UTC date/time	Displays the UTC date and time of the internal clock. The local time can be derived from the UTC time (Universal Time Coordinated) by adding or subtracting hours according to the specific time zone. For example, UTC plus one hour delivers the Central European Time CET (plus two hours during daylight saving time). See the **Output** status page (see page 43) or the **Output** configuration page (see page 57) for more information.
Product name	Displays the exact product name.
Serial number	Displays the serial number of *TICRO 100*.
Software version	Displays the software version currently installed on *TICRO 100*.
Kernel version	Displays the kernel version used in the currently installed operating software.
Hardware revision	Displays the hardware version of *TICRO 100*.
FPGA version	Displays the FPGA firmware version of *TICRO 100*.
Uptime	Displays the time *TICRO 100* is in operation since the last power-up or reset.

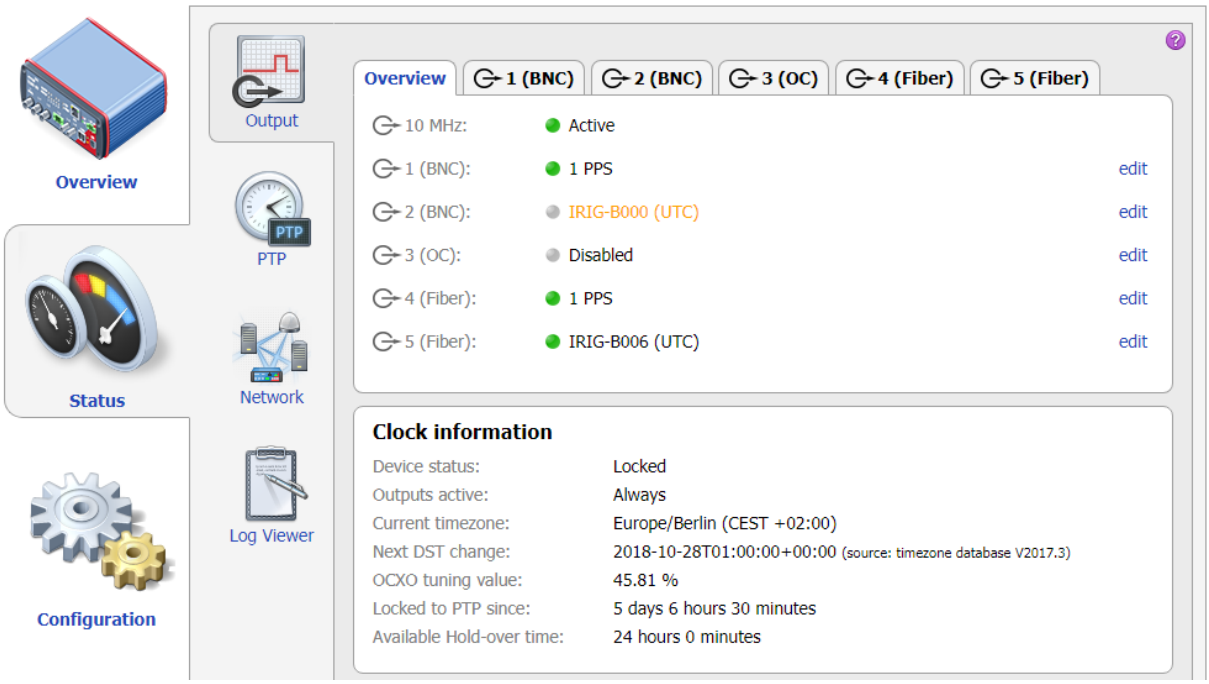
Network pane

The following is a short description of the information displayed in the **Network** pane of the **Overview** section. Refer to the **Network** status page (see page 53) or the **Network** configuration page (see page 68) for more information about the network settings.

IPv4 address	Displays the currently assigned IPv4 address of *TICRO 100*. If configured dynamically, the IP address is assigned automatically by an IPv4 DHCP server (if available in the network) or *TICRO 100* itself. The IPv4 address can also be set manually by the user.

IPv6 address	Displays the currently assigned IPv6 address of *TICRO 100*. If configured dynamically and a IPv6 router is available in the network, the IP address is assigned automatically. The IPv6 address can also be set manually by the user.
MAC address	Displays the unique MAC address (Media Access Control Address) of *TICRO 100*.
Host name	Displays the host name of *TICRO 100*. The host name is set to the serial number by default but can be changed by the user. The serial number is available on the type plate on the bottom side of *TICRO 100*.
Domain name	Displays the domain name set by the user (e.g.: omicron.at).

8.2 Status section

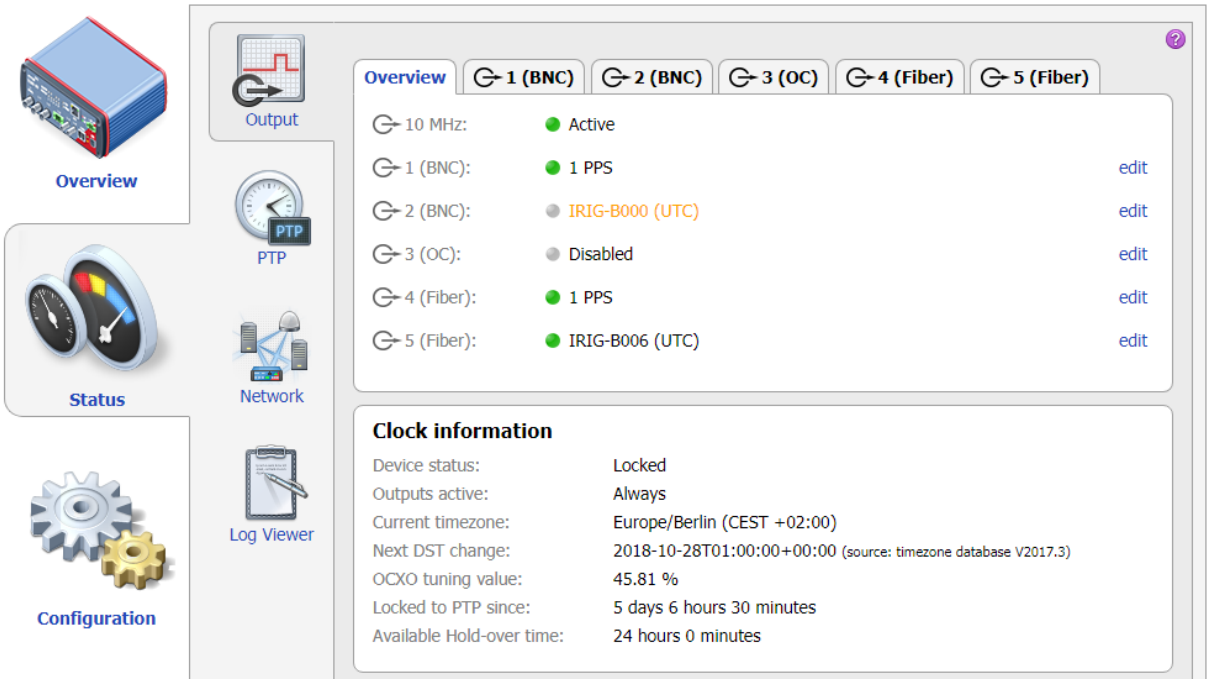


The status information is presented in four pages:

- **Output** (see page 43)
- **PTP** (see page 47)
- **Network** (see page 53)
- **Log Viewer** (see page 55)

Some elements provide an **edit** hyperlink. Click this hyperlink to directly open the corresponding configuration page (see page 56).

8.2.1 Output status page



The **Output** status page displays the configurations and states of the outputs, and information about the settings and the status of the internal clock.

Output tabs Overview, 1 (BNC), 2 (BNC), 3 (OC), 4 (Fiber) and 5 (Fiber)

The **Overview tab** displays an overview of the states and the configured time signals (IRIG-B, PPX, DCF77, etc.) for all available outputs. An LED indicates whether the output is active or not:

1 PPS	Green LED: Output active
IRIG-B000	Gray LED, text displayed in orange: Output muted
Disabled	Gray LED, text displayed in black: Output disabled

The **tabs for the individual outputs** are named by the output number and the interface or socket type, for example **2 (BNC)** for BNC output 2, or **4 (Fiber)** for fiber-optic output 4. The information displayed in these tabs depends on the signal mode configured for the specific output (IRIG-B, PPX, DCF77, etc.). Please refer to section Output configuration page on page 57 for detailed information about the parameters and settings available for the individual output signal modes.

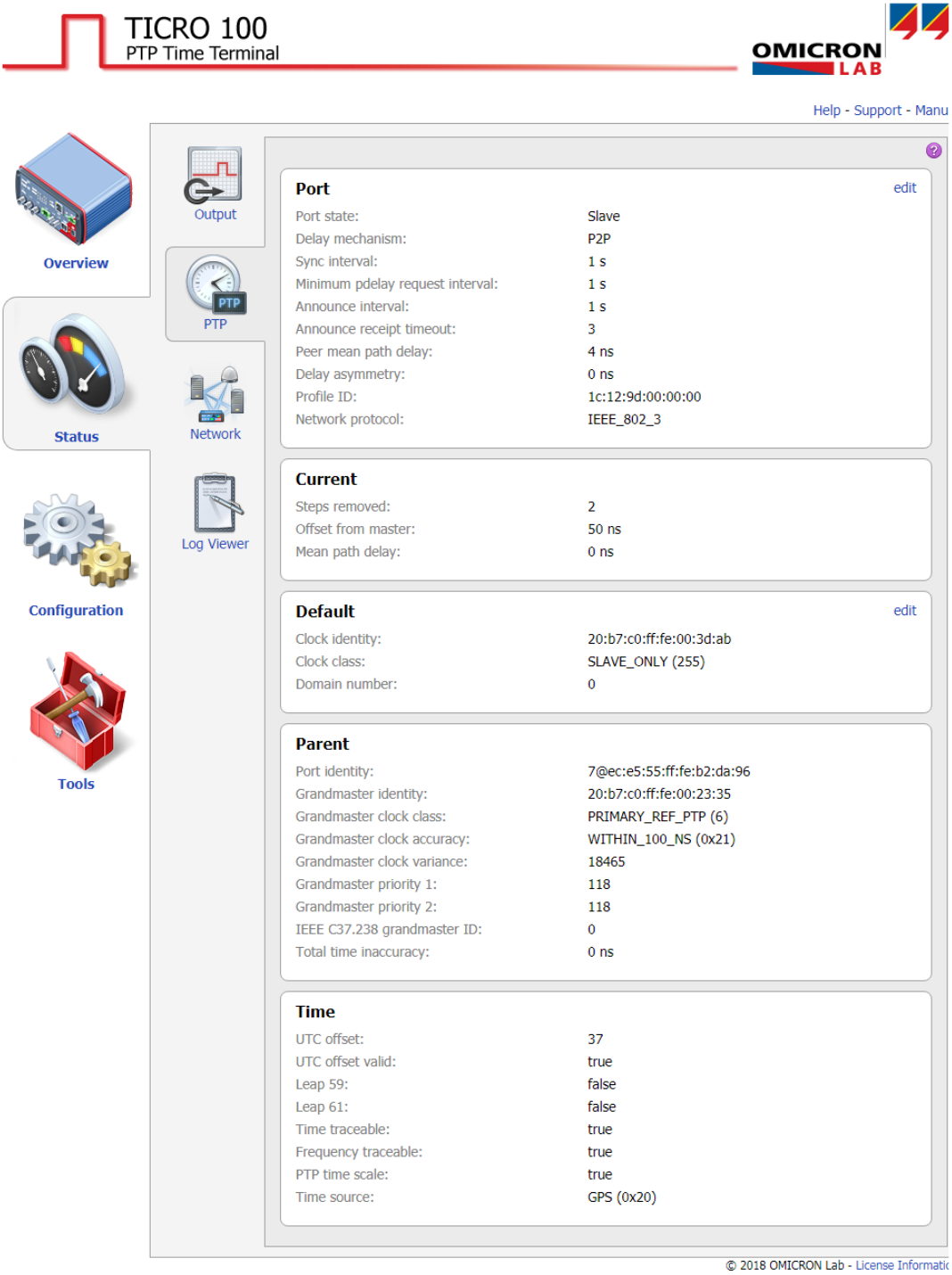
Clock information pane

Device status	Displays the device status of *TICRO 100*. The following device states are possible: **Initializing**: The boot process of *TICRO 100* is in progress after providing supply voltage to the device or after a device reboot. After the boot process is finished, *TICRO 100* changes to the Locking state if a usable PTP grandmaster clock is available in the network. Otherwise it remains in the Initializing state. **Locking**: *TICRO 100* tries to lock to the PTP time signal. If it is able to lock to a PTP grandmaster clock within a maximum of 5 minutes, *TICRO 100* changes to the Locked state. If not, it changes to the Unlocked state. **Locked**: *TICRO 100* receives PTP time information from a PTP grandmaster clock and is locked to this signal. It is able to provide its defined accuracy. The typical overall accuracy of better than 200 ns is reached after approximately 30 seconds of operation in the Locked state. Please note that the absolute overall system accuracy depends on the accuracy of the PTP grandmaster clock and the PTP compliance of the network infrastructure.  *TICRO 100* is equipped with an oven-controlled oscillator (OCXO). To ensure precise time synchronization, *TICRO 100* will only lock to the PTP time signal after an initial heat-up phase for the OCXO. The duration of this heat-up phase depends on the ambient temperature and is typically 5 - 7 minutes. **Hold-over**: If *TICRO 100* was in the Locked state before, it enters the Hold-over state if synchronization to the PTP time signal gets lost. If configured in the output configuration (see page 57), *TICRO 100* continues to output time signals during the Hold-over state. However, synchronization of these output signals is then performed using the internal oscillator (OCXO) instead of the PTP time signal. The maximum hold-over duration depends on the time *TICRO 100* was in the Locked state before: - Locked state ≤ 1 h: Hold-over time = 1 min ("mini hold-over"). - Locked state > 1 h **and** operating time (uptime) > 2 h: Hold-over time = half the operating time. - Locked state > 1 h **and** operating time > 48 h: Max. hold-over time = 24 h. The "unconsumed" hold-over time remaining on the return to the Locked state ist kept and extended by the "locked" duration as stated above. **Unlocked**: *TICRO 100* could not synchronize to a PTP time signal and reach its defined accuracy within 5 minutes after powering-up (or a device reboot), or the Hold-over state elapsed when *TICRO 100* was in the Locked stated before and lost synchronization. **Hardware error**: The device-internal hardware check failed. Reboot *TICRO 100* (see Device Control page on page 78). If the hardware error status still persists after the reboot, send your *TICRO 100* to OMICRON Lab for repair (for contact information, please refer to section Support on page 93).

Outputs active	*TICRO 100* can be configured to automatically deactivate its outputs if it is not able to provide time signals with sufficient accuracy. The behavior of this automatic deactivation is defined in the **Output** configuration page (see page 57). This parameter indicates in which device states *TICRO 100* outputs are active. Possible settings are: "Always", "only when locked" or "when locked or in hold-over". Please refer to the output configuration section (see page 57) for more detailed information.  Please note: The 10 MHz output signal is always available on the 10 MHz output after the boot process is finished. This signal is independent from the synchronization to a PTP signal.
Current timezone	Displays the timezone set for the internal clock in the **Output** configuration page (see page 57) together with the corresponding offset from UTC in brackets. Examples: • **Europe/Vienna (CEST +02:00)** for Central European Summer Time which has an offset of +2 hours from UTC. • **UTC (UTC + 00:00)** for UTC. • **Manual DST change** if the date and time for the next DST switching have been set manually. • **Manual rule (+2:00)** if a manual rule is used for DST switching.
Next DST change	Date of next switching between winter time and summer time. Example: 2018-10-28T01:00:00+00:00 (source: timezone database v2017.3).
DST on	Only available if **Current timezone** is set to **Manual rule**. Date of next switching from winter time to summer time. Example: Last sunday of March at 01:00 UTC to +02:00 (source: Manual rule).
DST off	Only available if **Current timezone** is set to **Manual rule**. Date of next switching from summer time to winter time. Example: Last sunday of September at 02:00 UTC to +01:00 (source: Manual rule).

OCXO tuning value	For new OCXO oscillator components, the OCXO tuning value should be between 10 % and 90 % during the Locked state of *TICRO 100*. The OCXO oscillator is tuned by an external voltage to hold its frequency at the correct value. The OCXO tuning value represents the height of this tuning voltage. A change of the OCXO tuning value is often caused by oscillator aging. In such cases, the OCXO approaches the end of its life time if the OCXO tuning value is above 90 % or below 10 % during the Locked state of *TICRO 100*. If so, you should arrange replacement of the OCXO in near future. A message is displayed if the OCXO tuning value is close to the border of the maximum tuning range: • *OCXO tuning value is close to the border of tuning range*: This warning is displayed if the OCXO tuning value is above 94 % or below 6 % of its maximum range. • *OCXO tuning value is out of tuning range*: This error is displayed if the OCXO tuning value is above 98 % or below 2 % of its maximum range. (*TICRO 100* is no longer able to lock to the connected PTP grandmaster clock if the OCXO tuning value is out of the tuning range.) Please note that extremely high or low OCXO tuning values may also be caused by incorrect timing information, for example, due to missing GPS synchronization of the clock. In such cases, *TICRO 100* will try to tune its oscillator to meet this incorrect timing information until the border of the OCXO's tuning range is reached.
Locked to PTP since	Displays the time *TICRO 100* is in the Locked state.
Available hold-over time	Displays the time *TICRO 100* is able operate in the hold-over mode without synchronization to a PTP time signal. For more detailed information about the Hold-over state, please refer to Device status on page 44.

8.2.2 PTP status page



The following information is displayed in the **PTP** status page.

Port pane

The **Port** pane displays information on the current state and configuration of the PTP port of *TICRO 100*.

Port state	Displays the current PTP state of the network port of *TICRO 100*. **Listening**: After initialization, *TICRO 100* is listening for messages from a PTP grandmaster clock (e.g., an *OTMC 100*) in the network. The purpose of this state is to allow orderly addition of a clock to a domain in the network. If so, *TICRO 100* enters the uncalibrated state. **Uncalibrated**: This is a transient state to allow synchronization to a PTP time signal. After synchronization, *TICRO 100* enters the **slave** state. **Slave**: *TICRO 100* receives PTP time information from a grandmaster with sufficient accuracy via the network port. It is synchronized to a PTP signal (normal operating state). **Faulty**: *TICRO 100* detected a fault condition. Further details about the error can be found in the log file. Synchronization to a PTP time signal is not possible. **Disabled**: The PTP service has been disabled in the network configuration (see page 68) of *TICRO 100* or via the Application Programming Interface API. *TICRO 100* cannot synchronize to a PTP time signal. See IEEE 1588-2008, clause 9.2.5 for more detailed information.
Delay mechanism	Displays which PTP delay mechanism is currently used by *TICRO 100*. The value of this parameter may either be E2E (end-to-end) or P2P (peer-to-peer). The PTP delay mechanism used depends on the PTP profile selected in the PTP configuration (see page 64).
Sync interval [s]	Displays the mean synchronization interval for multicast messages (interval between successive Sync messages). This parameter is set in the PTP configuration (see page 64). Sync Interval = $2^{\text{Log sync interval}}$ seconds, see IEEE 1588-2008, clause 8.2.5.4.3.
Minimum pdelay request interval [s]	Displays the minimum permitted mean time interval between successive Pdelay_Req messages. See "logMinPdelayReqInterval" in IEEE 1588-2008. *Only available for PTP profiles Default P2P, Power (C37.238-2011), Power (C37.238-2017), and Power utility (61850-9-3:2016).* This parameter is set in the PTP configuration (see page 64). Minimum pdelay request interval = $2^{\text{Log min pdelay request interval}}$ seconds, see IEEE 1588-2008, clause 8.2.5.4.5.

Minimum delay request interval [s]	Displays the minimum permitted mean time interval between successive Delay_Req messages. This value is determined and advertised by a master clock based on the ability of the master. *Only available for PTP profile Default E2E.* This parameter is set in the PTP configuration (see page 64). Minimum delay request interval = $2^{\text{Log min delay request interval}}$ seconds, see IEEE 1588-2008, clause 8.2.5.3.2.
Announce interval [s]	Displays the mean time interval between successive Announce messages. See IEEE 1588-2008, clause 8.2.5.4.1. This parameter is set in the PTP configuration (see page 64). Announce interval = $2^{\text{Log announce interval}}$ seconds.
Announce receipt timeout	Displays the number of "Announce Interval" intervals that have to pass without the receipt of an Announce message before an ANNOUNCE_RECEIPT_TIMEOUT_EXPIRES event occurs. See IEEE 1588-2008, clause 8.2.5.4.2. This parameter is set in the PTP configuration (see page 64).
Peer mean path delay [ns]	Displays the estimate of the current one-way propagation delay on the link computed using the peer delay mechanism. This parameter is not displayed if the delay mechanism is E2E. See IEEE 1588-2008, clause 8.2.5.3.3.
Delay asymmetry [ns]	Displays the asymmetry delay. The asymmetry delay is defined to be positive when the master-to-slave or responder-to-requestor propagation time is longer than the slave-to-master or requestor-to-responder propagation time. See IEEE 1588-2008, clause 7.4.2. Time (master -> slave) = meanPathDelay + delayAsymmetry Time (slave -> master) = meanPathDelay - delayAsymmetry
Profile ID	Displays the profile identity. The profile identity identifies the PTP profile implemented by the port indicated by the targetPortIdentity.portNumber member of the field. See IEEE 1588-2008, clause 15.5.3.1.2.10.
Network protocol	Displays the network protocol selected for the Transport parameter in the PTP configuration (see page 64). Possible values are "UDP IPv4" (transport via UDP packets over IPv4), "UDP IPv6" (transport of the PTP packets via UDP over IPv6), and IEEE 802.3 (transport via Ethernet packets according to IEEE 802.3).
VLAN ID	Displays the Vlan ID. The Power profile according to IEEE C37.238-2011 requires an IEEE 802.1Q VLAN tag. This value represents the VID (VLAN Identifier) field (12 bits) within the TCI (Tag Control Identifier). See IEEE C37.238-2011, clause 5.6. *Only available for PTP profile Power (C37.238-2011).* This parameter is set in the PTP configuration (see page 64).

VLAN priority	Displays the Vlan priority. The Power profile according to IEEE C37.238-2011 requires an IEEE 802.1Q VLAN tag. This value represents the PCP (Priority Code Point) field (3 bits) within the TCI (Tag Control Identifier). See IEEE C37.238-2011, clause 5.6. *Only available for PTP profile Power (C37.238-2011).* This parameter is set in the PTP configuration (see page 64).

Current pane

Steps removed	Number of master and boundary clocks between the PTP grandmaster clock and *TICRO 100*.
Offset from master [ns]	Offset of the *TICRO 100* OCXO from the master oscillator in ns. This value is updated with every Sync message.
Mean path delay [ns]	Delay from the PTP master to the PTP slave. *Only visible if E2E synchronization is used.*

Default pane

The **Default** pane displays the current configuration/state of the internal clock of *TICRO 100*.

Clock identity	Displays the clock identity. IEEE 1588-2008, clause 7.5.2.2, requires that each clock in a PTP network has a unique clock identifier. This identifier is an 8-octet array. *TICRO 100* automatically sets the clock identity to a unique value based on the device's MAC address according to IEEE 1588-2008, clause 7.5.2.2.2.
Clock class	Displays the current clock class of *TICRO 100* (see IEEE 1588-2008, clause 7.6.2.4). The clock class is broadcast in the corresponding PTP data packets. The value of the clock class parameter is automatically set by *TICRO 100*. Currently, *TICRO 100* supports only the Slave clock class, i.e., it always receives its time information from a grandmaster.
Domain number	Displays the domain number of *TICRO 100*. The domain number specifies the PTP domain (see IEEE 1588-2008, clause 7.1) in which *TICRO 100* participates. All clocks in a network that shall be synchronized to each other must participate in the same PTP domain, i.e., have the Domain number parameter set to the same value. This parameter is set in the PTP configuration (see page 64).

Parent pane

The **Parent** pane displays information about the current grandmaster clock of the network/domain in which *TICRO 100* operates.

A warning is displayed if *TICRO 100* was locked to a PTP master and the connection gets lost: "In Listening State values received from the previous grandmaster are displayed until PTP messages from a new grandmaster are received!"

Port identity	Displays the port identity. This parameter states the port identity of *TICRO 100* as defined by IEEE 1588-2008, clause 7.5.2, in the format portNumber@clockIdentity.

Grandmaster identity	Displays the grandmaster identity. This is the unique identifier of the clock that is currently the grandmaster clock of the network or domain in which *TICRO 100* participates.
Grandmaster clock class	Displays the grandmaster clock class. This parameter specifies the current clock class of the current grandmaster clock in the network or domain (see IEEE 1588-2008, clause 7.6.2.4). The value of the Grandmaster clock class parameter is automatically set by the current grandmaster clock depending on the source of time that is currently available.
Grandmaster clock accuracy	Displays the current accuracy of the internal clock of the current grandmaster clock with regard to TAI. See IEEE 1588-2008, clause 7.6.2.5 for details.
Grandmaster clock variance	Displays the grandmaster clock variance. The Grandmaster clock variance parameter is set to the PTP variance value specified by IEEE 1588-2008, clause 7.6.3. This parameter gives a measure for the stability of the internal oscillator of the current grandmaster clock and is used in the Best Master Clock Algorithm (BMCA) of the PTP protocol.
Grandmaster priority 1 Grandmaster priority 2	Displays the priority 1 and 2 of the current grandmaster clock. If more than one PTP grandmaster clock is available in the network, a clock with a lower Priority 1 value will always be the preferred master clock over a clock with a higher Priority 1 value (see IEEE 1588-2008, clause 6.6.2.3). A value in the range from 0 to 255 may be assigned to the Priority 1 parameter (see IEEE 1588-2008, clause 7.6.2.2). The Priority 2 parameter (see IEEE 1588-2008, clause 7.6.2.3) is used if several devices have the same Priority 1 parameter value and the same clock quality (class, accuracy and variance). The Priority 2 parameter thus allows a finer grained ordering among otherwise equivalent clocks (see IEEE 1588-2008, clause 6.6.2.3). Lower values take precedence.
IEEE C37.238 grandmaster ID	Displays the grandmaster identity announced in IEEE C37.238 TLV. By sending this ID, the current grandmaster clock identifies itself as a valid power profile grandmaster. A C37.238-2011 power profile slave will ignore all masters that do not provide a setting for this field. In C37.238-2017, the grandmaster is no longer ignored. *Only available for PTP profiles Power (C37.238-2011) and Power (C37.238-2017).*
Total time inaccuracy	IEEE C37.238 totalTimeInaccuracy provides a mechanism using the profile-specific IEEE_C37_238 TLV defined in clause 6.2, for applications to determine whether the time inaccuracy in the delivered time is acceptable. The total time inaccuracy comprises the sum of the following three values: - Grandmaster time inaccuracy - Distribution time inaccuracy - Source time inaccuracy These three items are summed in the totalTimeInaccuracy field. This field is initialized by the grandmaster to the grandmaster time inaccuracy plus the source time inaccuracy, and then incremented by TCs and BCs *Only available for PTP profile Power (C37.238-2017).*

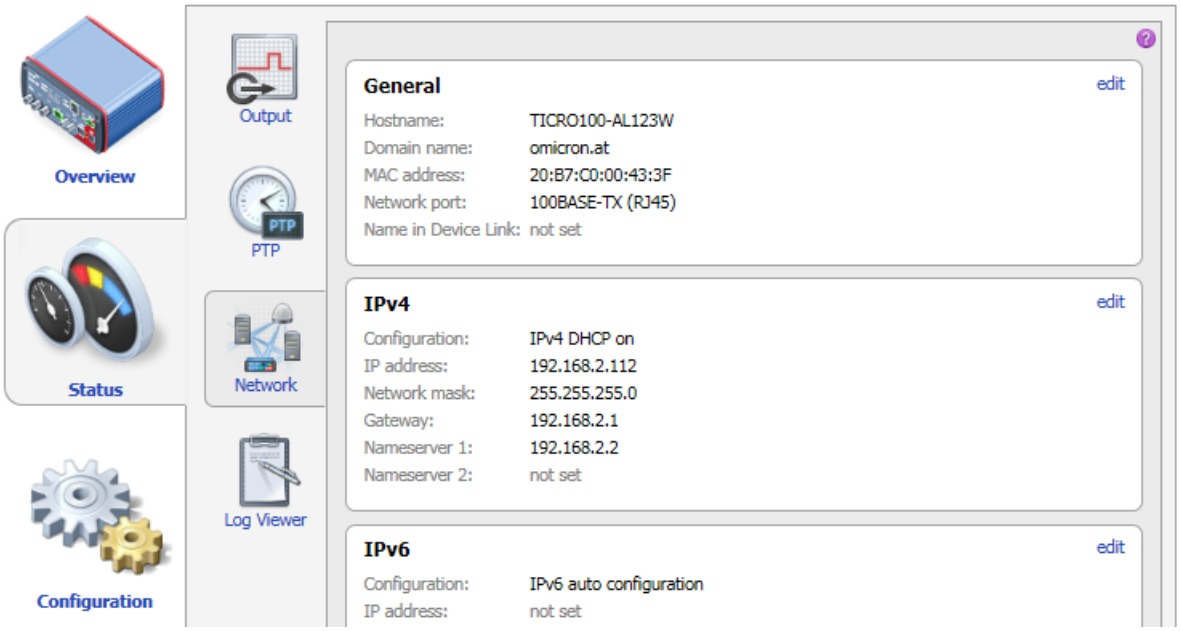
Local time inaccuracy	Displays the maximum time inaccuracy in ns that the device contributes to the network time inaccuracy. See IEEE C37.238-2011, clause 5.13. *Only available for PTP profile Power (C37.238-2011).* This parameter is set in the PTP configuration (see page 64).
Network time inaccuracy	Displays the network time inaccuracy in ns to be transmitted in IEEE C37.238 TLV. See IEEE C37.238-2011, clause 5.13. *Only available for PTP profile Power (C37.238-2011).* This parameter is set in the PTP configuration (see page 64).

Time pane

The **Time** pane displays parameters for the time that is currently distributed in the PTP network or domain in which *TICRO 100* participates (e.g., epoch related parameters like UTC offset or leap second information), and parameters of the time source currently used. This pane lists the parameter values of the current grandmaster clock in the network or domain. The data listed here represents the Time Properties Data set specified in IEEE 1588-2008, clause 8.2.4.

UTC offset	Displays the UTC offset. In PTP systems whose epoch is the PTP epoch, the value is the offset between TAI and UTC in seconds; otherwise the value has no meaning. See IEEE 1588-2008, clause 8.2.4.2.
UTC offset valid	True indicates that the value of the UTC offset parameter is valid. Otherwise false. See IEEE 1588-2008, clause 8.2.4.3.
Leap 59 Leap 61	Displays the boolean values that are used to notify the clocks in the network or domain that a UTC leap second is pending. Leap 59 = True means that the last minute of the current UTC day contains only 59 seconds (see IEEE 1588-2008, clause 8.2.4.4). Leap 61 = True means that the last minute of the current UTC day contains 61 seconds (see IEEE 1588-2008, clause 8.2.4.5).
Time traceable	True indicates that the time currently distributed in the network or domain is traceable to a primary reference, e.g., to GPS (see IEEE 1588-2008, clause 8.2.4.6)
Frequency traceable	True indicates that the frequency determining the timescale currently distributed in the network or domain is traceable to a primary reference, e.g., to GPS (see IEEE 1588-2008, clause 8.2.4.7).
PTP time scale	True indicates that the timescale distributed in the network or domain is the PTP timescale, i.e., TAI time. False if an arbitrary timescale is used. See IEEE 1588-2008, clause 8.2.4.8.
Time source	Displays the source of time that is used by the current PTP grandmaster clock (see IEEE 1588-2008, clause 8.2.4.9). Possible values for this parameter are listed in IEEE 1588-2008, clause 7.6.2.6. Example: GPS (0x20) means that the current PTP grandmaster clock is synchronized to a satellite system like GPS.

8.2.3 Network status page



The following information is displayed in the **Network** status page.

General pane

The **General** pane displays the general network configuration settings of *TICRO 100*.

Hostname	Displays the host name of *TICRO 100*. The host name is set to the serial number by default but can be changed by the user in the network configuration (see page 68). The serial number is available on the type plate on the bottom side of *TICRO 100* (labeled "SerNo").
Domain name	Displays the domain name set by the user in the network configuration (see page 68) (e.g.: omicron.at).
MAC address	Displays the unique MAC address (Media Access Control Address) of *TICRO 100*.
Network port	Displays the network port (RJ45 or Fiber) currently selected by the automatic detection function of *TICRO 100* or set by the user in the network configuration (see page 68).
Name in Device Link	Name under which the *TICRO 100* device is displayed in OMICRON *Device Link*. You can set this name in the network configuration (see page 68).

IPv4 pane

The **IPv4** pane displays the IPv4 specific configuration settings of *TICRO 100*. The IPv4 configuration is set in the network configuration (see page 68).

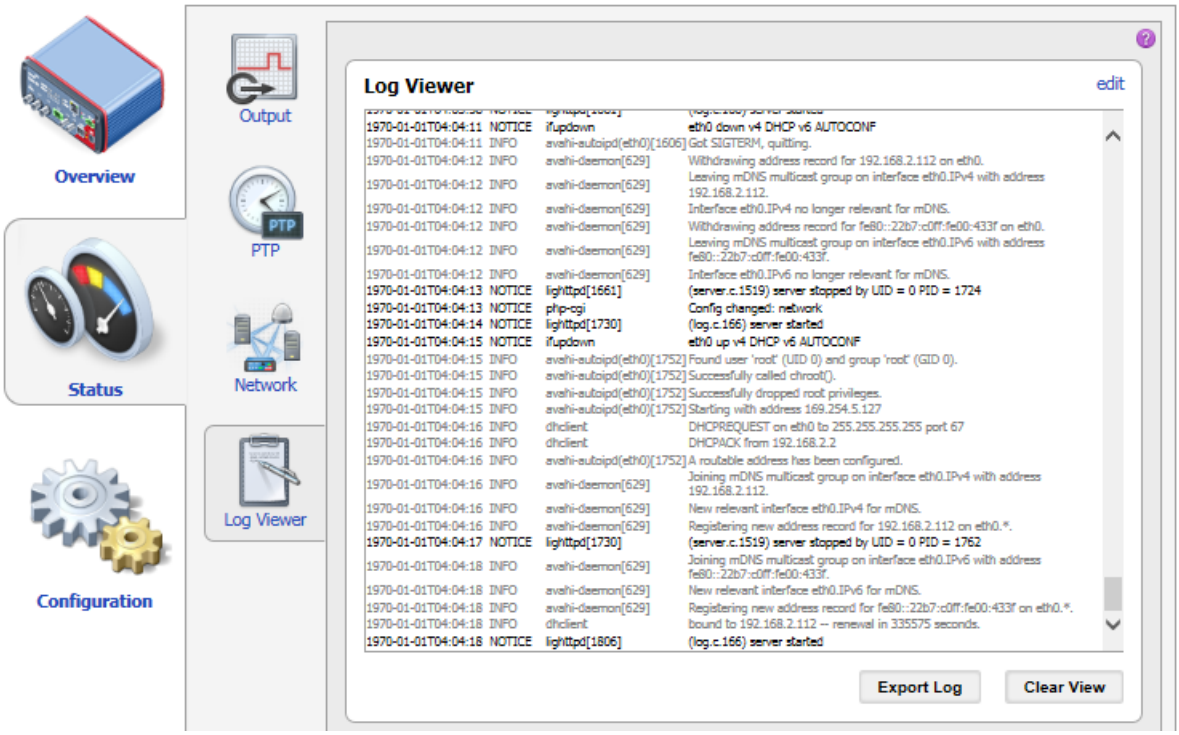
Configuration	Displays the configuration method selected for IPv4. **IPv4 disabled**: IPv4 is switched off. **IPv4 static IP address**: The IP address was assigned manually by the user. **IPv4 DHCP on**: The IP address was assigned automatically by a DHCP server.
IP address	Displays the currently assigned IPv4 address of *TICRO 100* (e.g.: 192.168.1.100).
Network mask	Displays the network mask in dot-decimal notation (e.g.: 255.255.255.0).
Gateway	If set, this parameter displays the gateway address in dot-decimal notation (e.g.: 192.168.1.1).
Nameserver 1 Nameserver 2	If set, these parameters display the address of the first and second name server selected in dot-decimal notation (e.g.: 192.168.1.50).

IPv6 pane

The **IPv6** pane displays the IPv6 specific configuration settings of *TICRO 100*. The IPv6 configuration is set in the network configuration (see page 68).

Configuration	Displays the configuration method selected for IPv6. **IPv6 disabled**: IPv6 is switched off. **IPv6 static IP address**: The IP address was assigned manually by the user. **IPv6 auto configuration**: The IP address was assigned automatically using the Stateless Address Autoconfiguration (SLAAC). **IPv6 auto configuration (manual DNS)**: The IP address was assigned automatically using the Stateless Address Autoconfiguration (SLAAC) but the user manually specified possible DNS servers in the network configuration (see page 68).
IP address	Displays the currently assigned IPv6 address of *TICRO 100*.
Network mask	Displays the network mask in dot-decimal notation.
Gateway	If set, this parameter displays the gateway address in hexadecimal notation.
Nameserver 1 Nameserver 2	If set, these parameters display the address of the first and second name server in hexadecimal notation.
Link local address Link local mask	Displays the link local address and the respective mask automatically assigned by the Stateless Address Autoconfiguration (SLAAC) if the **IPv6 auto configuration** option is selected for IPv6 in the network configuration (see page 68).

8.2.4 Log Viewer page



The **Log Viewer** page shows all events logged in the internal log file. Which types of events are actually logged by the system can be selected in the log & notifications configuration (see page 71).

ERR Error messages are displayed in red.

WARNING Warning messages are displayed in orange.

NOTICE Notice messages are displayed in black.

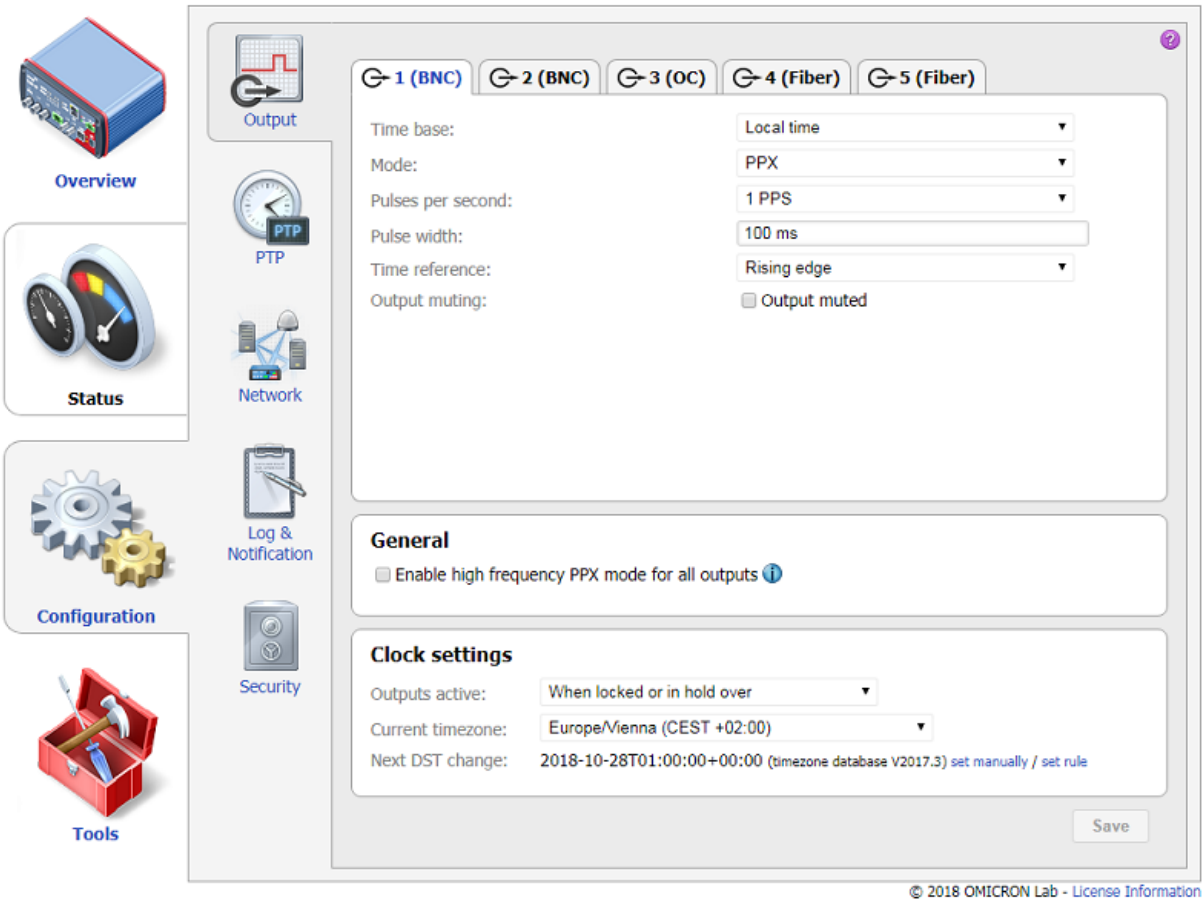
INFO All other messages (debug messages, information, etc.) are displayed in gray.

Click **Clear View** to delete the messages displayed in the **Log Viewer** window. This does not clear the log file. Re-opening the **Log Viewer** will again display all messages logged in the log file.

Click **Export Log** to export the log file content to a text file (file extension .log).

If the maximum size of the log file is reached, the system automatically deletes old log file entries in order to release memory space for new entries.

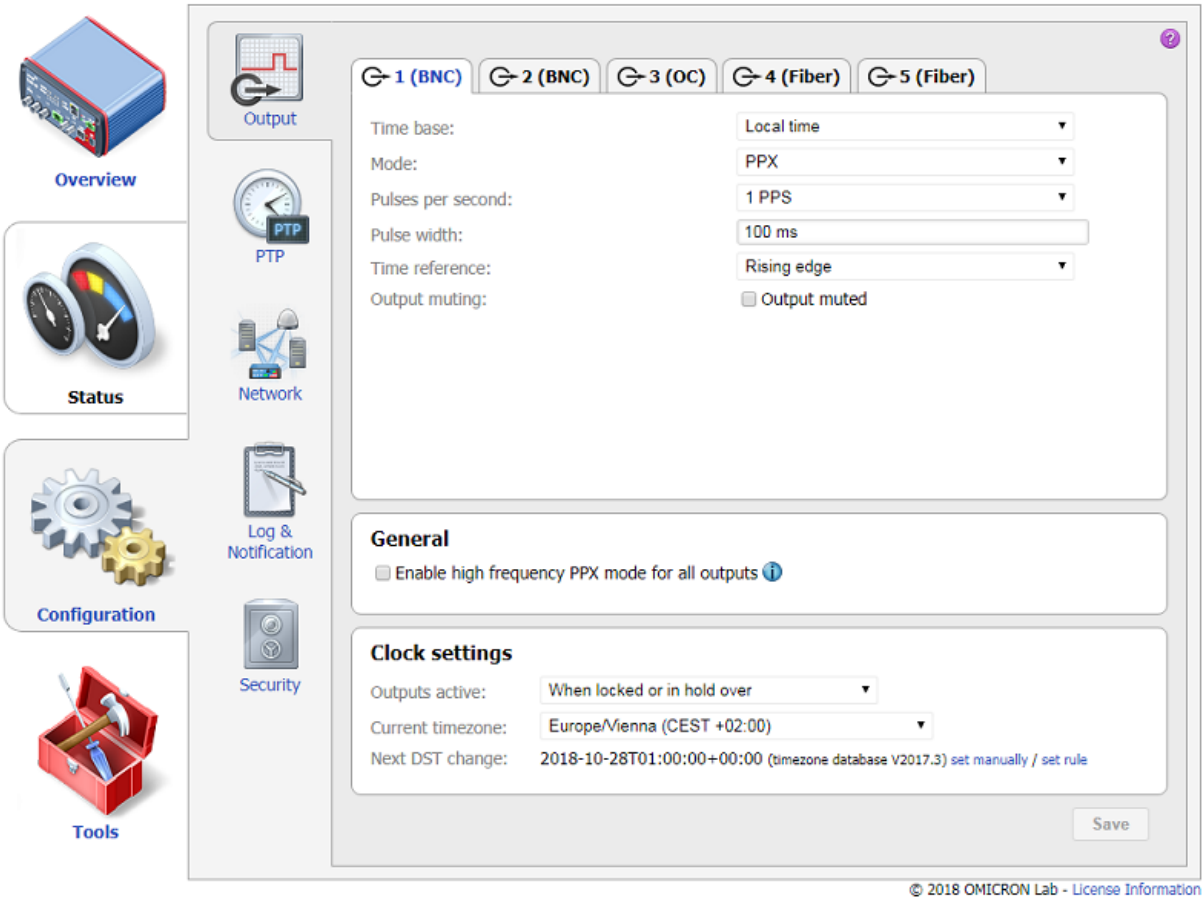
8.3 Configuration section



Configuration of *TICRO 100* is done in five pages:

- **Output** (see page 57)
- **PTP** (see page 64)
- **Network** (see page 68)
- **Log & Notification** (see page 71)
- **Security** (see page 73)

8.3.1 Output configuration page



Select a tab to configure the corresponding output and/or specify the clock settings. Click the **Save** button to save and apply your changes to *TICRO 100*.

The 10 MHz signal output is always active and cannot be configured.

Output tabs 1 (BNC), 2 (BNC), 3 (OC), 4 (Fiber) and 5 (Fiber)

The configuration tabs for the individual outputs are named with the output number and the interface or socket type:
1 (BNC) and **2 (BNC)**: 50 Ω BNC outputs 1 and 2
3 (OC): Optocoupler output 3
4 (Fiber) and **5 (Fiber)**: Fiber-optic outputs 4 and 5

The possible output settings are to a wide extent identical for all outputs and types. They are explained in the following tables.

Time base	Select the time base used for the generation of the time signal of the corresponding output: TAI (International Atomic Time), UTC (Universal Time Coordinated) or Local time (time selected in the clock settings, for example CEST + 2:00 hrs). DCF77 signals are always based on Central European Time or Central European Summer Time (CET/CEST).
Mode	Select the time code of the output signal. Depending on the selected mode, additional configuration parameters are possibly available. **Disabled**: No signal is applied at the output. The output is always off. **IRIG-B**: The output provides an IRIG-B signal. For the BNC outputs 1 and 2 you can furthermore select whether this signal should be modulated or not. See the following table for the available parameters. **PPX**: The output provides a PPX signal. See the following table for the available parameters. **DCF77**: The output provides an unmodulated DCF77 time signal. No other configuration parameters are available for the DCF77 mode. **Trigger (single pulse)**: The output provides one pulse at a defined point in time. See the following table for the available parameters. **Trigger (PPX)**: The output provides a PPX signal starting at the defined point in time. See the following table for the available parameters.
Output muting	Use this check box to enable or mute the corresponding output. Muted outputs are always off.

Parameter name	Parameter available for mode				Description
	IRIG-B	PPX	Trigger (PPX)	Trigger (single pulse)	
Modulation	x (BNC only)				Select whether the output should deliver a modulated or an unmodulated IRIG-B time signal.
Coded expressions (see footnote 1)	x				Use the check boxes to specify the coded expressions the IRIG-B signal should contain: **Control functions** CF, **Straight binary seconds** SBS and/or **BCD_{YEAR}**. Select the **Use CTQ bits** check box to make use of the continuous time quality (CTQ) bits. CTQ bits provide information about the quality (time inaccuracy) of the IRIG-B signal. Please refer to the IRIG standard for more detailed information.
Parity bit calculation	x				Use this field to select the parity bit calculation (even or odd). Even is the default setting.
IRIG-B code of Output x	x				Displays the resulting IRIG-B code depending on the selection made under **Coded expressions**. See footnote 1 below.
Pulses per second		x	x		Select the number of pulses the output signal should contain: 1, 10, 100 or 1000 pulses per second (PPS), 1 pulse per minute (PPM) or 1 pulse per hour (PPH). Or select **Custom** and specify the pulse frequency in the **Set frequency** field. See footnote 2 below.
Pulse width (see footnote 3)		x	x		Enter the pulse width in ns for your PPX signal.
Time reference (see footnote 3)		x	x		Select whether the falling edge or the rising edge of the output pulse should be synchronized to the time base.
Next trigger			x	x	Select the point in time the trigger signal should occur (or start). Click the date field and select a date/time from the calendar dialog or select **Set to next full minute** or **Set to next full hour** to start the trigger at the next full minute or hour.

Footnote 1: Coded expressions

Using coded expressions, the IRIG-B signal can include additional information like control functions, straight binary seconds and BCD_{YEAR}. The naming of the IRIG-B code changes depending on the included information. Example: B000 is an IRIG-B signal with control functions and straight binary seconds activated. Refer to the following IRIG-B coding scheme.

IRIG-B Coding Scheme

	CF	SBS	BCD_{YEAR}
Bxx0	x	x	
Bxx1	x		
Bxx2			
Bxx3		x	
Bxx4	x	x	x
Bxx5	x		x
Bxx6			x
Bxx7		x	x

CF: Control Functions
SBS: Straight Binary Seconds

Source: IRIG Standard 200-04 (4.1 Time Code Formats)

Detailed information about the IRIG-B coding scheme can be found in the IRIG Standard 200-04 under "Time Code Formats".

Footnote 2: Setting the pulse frequency for PPX - Custom

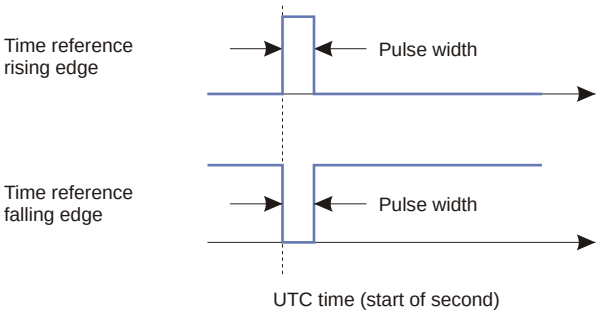
If **Custom** is selected for the **Pulses per second** field of the **PPX mode**, you have to specify the pulse frequency in the **Set frequency** field.

Enter a frequency using the multiplier of the value unit (for example, use "1k" for 1 kHz), and press the Enter key on your keyboard. *TICRO 100* will automatically check the admissibility of your input and calculate and use a permitted frequency as close as possible to the frequency entered. This value is displayed in the **Used frequency** field.

Possible values:

- 10 mHz to 1 MHz for outputs 1 & 2 (BNC) and outputs 4 & 5 (optical). If the **Enable high frequency PPX mode for all outputs** option is selected in the **General** pane (see below), the possible range is 10 mHz to 2.048 MHz.
- 10 mHz to 10 kHz for output 3 (optocoupler output)

Footnote 3: Pulse width and time reference
The following figure explains the pulse width and the time reference parameters.



General pane

Select the **Enable high frequency PPX mode for all outputs** check box to use pulse frequencies higher than 1 MHz in the **PPX - Custom** mode (see footnote 2 above). Selecting this check box will enable higher pulse frequency for all outputs using the **PPX - Custom** mode and possibly change existing frequency settings for the other outputs.

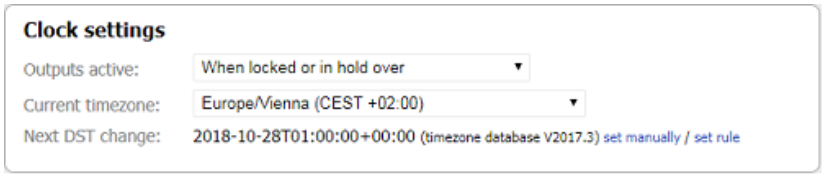
Selecting the **Enable high frequency PPX mode for all outputs** option will also have an effect on previously set frequencies because this option reduces the available frequency resolution for the permitted frequencies. You should use the high frequency PPX mode only if frequencies of more than 1 MHz are needed.

Clock settings pane

Outputs active	You can configure *TICRO 100* to automatically deactivate its outputs if it is not able to provide time signals with sufficient accuracy. Use this parameter to select the behavior of this automatic deactivation. **Always**: Automatic deactivation is switched off. The outputs are always on. **Only when locked**: *TICRO 100* deactivates the outputs if the device status is not locked. In the Locked state, the time signals provided by *TICRO 100* are synchronized to the received PTP time signal. **When locked or in hold over**: *TICRO 100* deactivates the outputs if the device is not in the Locked or the Hold-over state. In the Hold-over state, the time signals provided by *TICRO 100* are derived from the internal oscillator. For information about the device states, please refer to the description of the **Output** status page (see page 43).

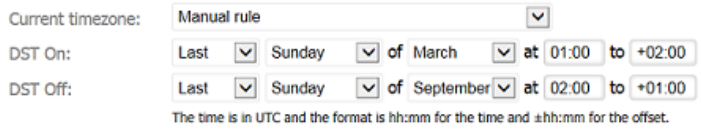
Current timezone	Select one of the timezones offered in the list or UTC. The displayed offset from UTC is used to calculate the local time of *TICRO 100* (for example, Europe/Vienna (CEST +2:00)). Or select **Manual DST change** or **Manual rule** from the list to set the timezone manually. Please refer to subsection "Setting daylight saving time changeovers manually" below.  The timezones offered in the list are defined in a timezone database stored on *TICRO 100*. Refer to section Software Update page on page 80 for information on how to receive a new time zone database.

Setting daylight saving time changeovers manually



Proceed as follows to set a manual rule (set rule):

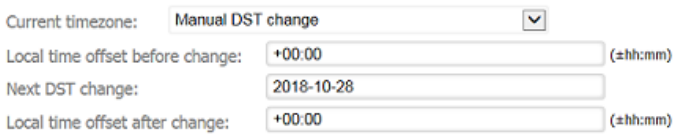
1. Select **Manual rule** from the **Current timezone** list or (if available) click the blue **set rule** text next to the **Next DST change** field to display additional fields for defining your rule.



2. Use the **DST On** fields to define the beginning, and the **DST Off** fields to define the end of the daylight saving time. Example: **Last Sunday** of **March** at **01:00** to **+02:00** for **DST On**.
3. Click the **Save** button to save and apply your settings to *TICRO 100*.

Proceed as follows to set daylight saving time changeovers manually (set manually):

1. Select **Manual DST change** from the **Current timezone** list or (if available) click the blue **set manually** text next to the **Next DST change** field to display additional fields for adjusting the timezone manually.



2. Enter the **local time offset** before the daylight saving time changeover and after the daylight saving time changeover to the corresponding fields. Use the requested format hh:mm.

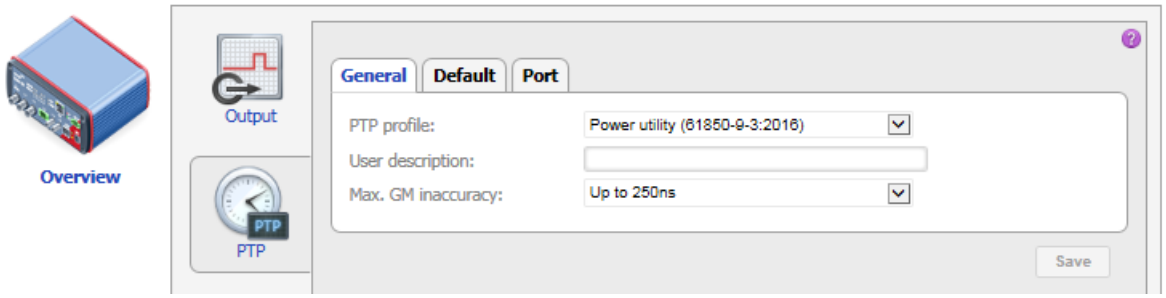
3. Click the **Next DST change** field to open a calendar dialog allowing for the selection of the date and time for the daylight saving time changeover. In this dialog, set the date and time or click **Now** to set it to the current date and time of your computer. Click **Done** to close the calendar and to apply your settings to the **Next DST change** field.

   A warning sign is displayed if the selected time for the next daylight saving time changeover is in the past.

4. Click the **Save** button to save and apply your settings to *TICRO 100*.

8.3.2 PTP configuration page



Select the corresponding tab to specify your PTP configuration settings. Click the **Save** button to save and apply your PTP configuration changes to *TICRO 100*.

General tab

PTP profile	Use this list box to select the PTP profile. **Power (C37.238-2011) - DEPRECATED**: The Power profile acc. to IEEE C37.238-2011 is obsolete. This PTP profile was initially intended for application in power system environments that use the Precision Time Protocol according to the IEEE Std. C37.238-2011 (IEEE Standard Profile for Use of IEEE 1588-2008 Precision Time Protocol in Power System Applications). **Power (C37.238-2017)**: Power profile acc. to IEEE C37.238-2017. Successor of the obsolete Power profile acc. to IEEE C37.238-2011. This PTP profile is intended for application in power system environments that use the Precision Time Protocol according to the IEEE Std. C37.238-2017 (IEEE Standard Profile for Use of IEEE 1588 Precision Time Protocol in Power System Applications). **Power utility (61850-9-3:2016)**: Power Utility Automation profile acc. to IEC 61850-9-3. This PTP profile is intended for application in power utility automation using the Precision Time Protocol according to IEC 61850-9-3:2016 (Precision time protocol profile for power utility automation). **Default E2E**: Default profile with the end-to-end mechanism as defined in IEEE 1588-2008. Intended for application in industrial environments that use the IEEE 1588-2008 Precision Time Protocol. **Default P2P**: Default profile with the peer-to-peer mechanism. Intended for application in industrial environments that use the IEEE 1588-2008 Precision Time Protocol.
User description	Enter a description for *TICRO 100*. This may be required to identify your *TICRO 100* uniquely if you are using more than one *TICRO 100* device in the network.

Max. GM inaccuracy	Select the maximum acceptable inaccuracy of the PTP time distributed in the network. If the inaccuracy of the PTP grandmaster clock is greater than this value, *TICRO 100* will no longer synchronize its output signals to the PTP grandmaster clock. *TICRO 100* will change to the Hold-over state and derive its output signals from its internal oscillator instead (see also the hold-over device state in the Output status page section (see page 43)).

Default tab

Domain number	The domain number specifies the PTP domain (see IEEE 1588-2008, clause 7.1) in which *TICRO 100* participates. All clocks in a network that shall be synchronized to each other must participate in the same PTP domain, i.e., have the Domain number parameter set to the same value.
Engineered network time inaccuracy	This value is set at the end device to represent the worst network time inaccuracy from this device to all preferred grandmasters. See "EngTimeInacc" in IEEE C37.238-2011. *Only available for PTP profile Power (C37.238-2011).*
Local time inaccuracy	This value shall be a more precise value of the clockAccuracy of the clockQuality field specified in clause 7.6.2.5 and Table 6 of the IEEE 1588-2008 standard. *Only available for PTP profile Power (C37.238-2011).*

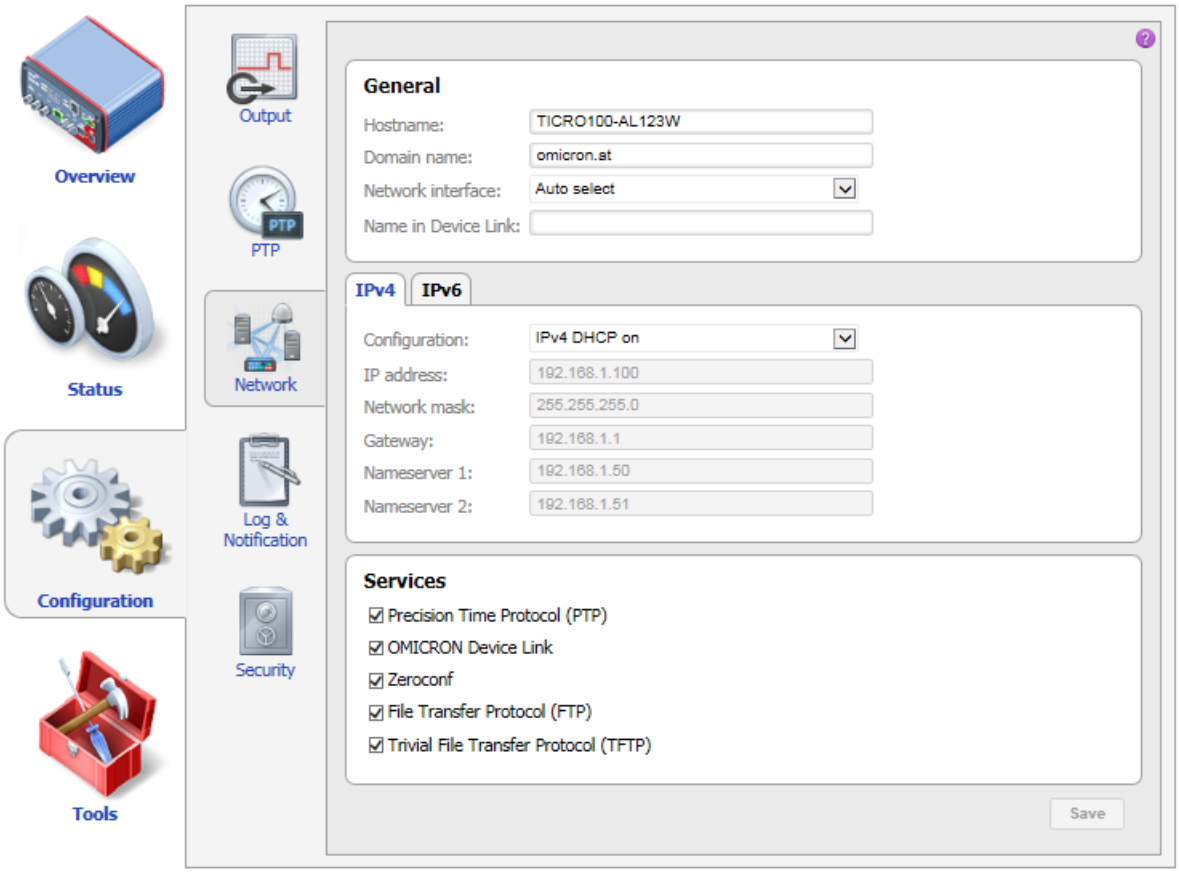
Port tab

Transport	Select the transport mechanism (network protocol) from the list. The protocols available in the list depend on the PTP profile selected: **UDP IPv4**: User Datagram Protocol (UDP) for Internet Protocol (IP) version 4. *Only available for PTP profiles Default E2E and Default P2P.* **UDP IPv6**: User Datagram Protocol (UDP) for Internet Protocol (IP) version 6. *Only available for PTP profiles Default E2E and Default P2P.* **IEEE 802.3**: Ethernet protocol according to IEEE 802.3.
VLAN ID	The Power profile according to IEEE C37.238-2011 requires an IEEE 802.1Q VLAN tag. This value represents the VID (VLAN Identifier) field (12 bits) within the TCI (Tag Control Identifier). See "VlanId" in IEEE C37.238-2011. *Only available for PTP profile Power (C37.238-2011).*
VLAN PCP	The Power profile according to IEEE C37.238-2011 requires an IEEE 802.1Q VLAN tag. This value represents the PCP (Priority Code Point) field (3 bits) within the TCI (Tag Control Identifier). *Only available for PTP profile Power (C37.238-2011).*

Log sync interval	Use this field to specify the logarithm to the base 2 of the mean synchronization interval (interval between successive Sync messages in 2^x seconds) for multicast messages. See "logSyncInterval" in IEEE 1588-2008. *Can only be changed for the PTP profiles Default P2P and Default E2E. For all other profiles, this value is fixed.* For example, a value of 2 will result in a synchronization interval of 4 seconds (= 2^2). Note: Sync interval = $2^{\text{Log sync interval}}$ seconds, see IEEE 1588-2008, clause 8.2.5.4.3.
Log min pdelay request interval	Use this field to specify the logarithm to the base 2 of the minimum permitted mean time interval between successive Pdelay_Req messages (interval in 2^x seconds). See "logMinPdelayReqInterval" in IEEE 1588-2008. *Only available for PTP profiles Default P2P, Power (C37.238-2011), Power (C37.238-2017), and Power utility (61850-9-3:2016). Can only be changed for the Default P2P profile. For all other profiles mentioned before, this value is fixed.* For example, a value of 0 will result in an interval of 1 second (= 2^0). Note: Minimum pdelay request interval = $2^{\text{Log min pdelay request interval}}$ seconds, see IEEE 1588-2008, clause 8.2.5.4.5.
Log min delay request interval	The logarithm to the base 2 of the minimum permitted mean time interval between successive Delay_Req messages (interval in 2^x seconds). This value is determined and advertised by a master clock based on the ability of the master. *Only available for PTP profile Default E2E.* For example, a value of 1 will result in an interval of 2 seconds (= 2^1). Range: Log sync interval <= Log minimum delay request interval <= Log sync interval + 5 Note: Minimum delay request interval = $2^{\text{Log min delay request interval}}$ seconds, see IEEE 1588-2008, clause 8.2.5.3.2. See IEEE 1588-2008 for more detailed information.
Log announce interval	Use this field to specify the mean time interval in 2^x seconds between successive Announce messages. See "logAnnounceInterval" in IEEE 1588-2008. *Can only be changed for the PTP profiles Default P2P and Default E2E. For all other profiles, this value is fixed.* For example, a value of 1 will result in an interval of 2 seconds (= 2^1).
Announce receipt timeout	Use this field to specify the number of "Log Announce Interval" intervals that have to pass without the receipt of an Announce message before an ANNOUNCE_RECEIPT_TIMEOUT_EXPIRES event occurs. See "announceReceiptTimeout" in in IEEE 1588-2008. *Can only be changed for the PTP profiles Default P2P and Default E2E. For all other profiles, this value is fixed.*

IPv6 multicast scope	*Only available if "Transport" is set to "UDP IPv6".* For UDP IPv6 transport, select the multicast scope that shall be used for all PTP messages except peer delay mechanism messages. For more detailed information, see IEEE 1588-2008, clause E.3, and IETF RFC 4921 (2006), section 2.7. For peer delay mechanism messages the IPv6 multicast address FF02::6B is used. For all other messages the IPv6 multicast address FF0X::181 is used, where the value of X is selected by the IPv6 multicast scope setting.  All clocks in a network that shall be synchronized via PTP over UDP IPv6 must use the same multicast scope setting. In earlier versions of the *TICRO 100* or *OTMC 100* firmware this setting is not available. The multicast scope is permanently set to "0x5: Site-Local scope" on these devices. Configure your *TICRO 100* to "0x5: Site-Local scope" to allow synchronization to such devices or update older devices with a new firmware image (see section Running a software update for TICRO 100 on page 31).

8.3.3 Network configuration page



The network configuration parameters and settings are organized in different panes and tabs. They are explained in the subsections below.

Click the **Save** button to save and apply your network configuration changes to *TICRO 100*.

General pane

Hostname	Host name (device name) of *TICRO 100*. The host name is set to the serial number by default but can be changed by the user.
Domain name	If a DHCP server is available in the network, *TICRO 100* receives the domain name from the DHCP server. The domain name can also be set manually by the user (e.g.: omicron.at).

Network interface	Select the network port *TICRO 100* should use for communication and reception of the PTP protocol. *TICRO 100* can use only one Ethernet port (RJ45 or fiber-optic port) at a time. **Auto select**: *TICRO 100* automatically detects on which port an operative Ethernet network is connected and selects this port for communication. *TICRO 100* selects the RJ45 port if no operative Ethernet network is detected on any port. This is the default setting of *TICRO 100* after the first power-up or after a factory reset. **100BASE-TX (RJ45)**: *TICRO 100* uses the RJ45 Ethernet port for communication, even if an operative Ethernet network is connected to its fiber-optic network port. **100BASE-FX (FIBER)**: *TICRO 100* uses the fiber-optic Ethernet port for communication, even if an operative Ethernet network is connected to its RJ45 network port.  It is strongly recommended to select the network port after powering up *TICRO 100* and accessing the *TICRO 100* Web Interface the first time. Otherwise *TICRO 100* could possibly select the wrong port if, for example in case of a voltage outage, *TICRO 100* comes up before the network is available.  If you selected a specific network port (RJ45 or fiber-optic) and applied this setting to *TICRO 100*, it is no longer possible to access the *TICRO 100* Web Interface via the other network port. To change this port selection, you must then access the *TICRO 100* Web Interface via the USB port or perform a factory reset using the reset button on the device (see section Performing a factory reset (reset to factory defaults) on page 35) to reset the network interface configuration to the default settings.
Name in Device Link	Use this field to enter a name or short description for your *TICRO 100* to facilitate identification of your device in OMICRON *Device Link*. Click the **Save** button to apply your entry. OMICRON *Device Link* will then display the name specified in this field together with the type and serial number of your device.

IPv4 tab

Click this tab to configure the IPv4 settings according to your needs:

IPv4 disabled	IPv4 is switched off.
IPv4 static IP address	Select **static** to set the IP address manually. The page then displays fields for entering the **IP address**, the **Network mask**, the **Gateway** address and the **Name server** address in dot-decimal notation (e.g.: 192.168.1.100).
IPv4 DHCP on	The IP address is assigned automatically by a IPv4 DHCP server (if available in the network) or by *TICRO 100* itself. The IP address assigned is displayed in the **Network** status page (see page 53) and the **Overview** page (see page 38).

IPv6 tab

Click this tab to configure the IPv6 settings according to your needs:

IPv6 disabled	IPv6 is switched off.
IPv6 static IP address	Select **static** to set the IP address manually. The page then displays fields for entering the **IP address**, the **Gateway** address and the **Name server** address in hexadecimal notation (e.g.: 2607:f0d0:2001:a::10), and the **Network mask** in decimal notation.
IPv6 auto configuration IPv6 auto configuration (manual DNS)	The IP address is assigned automatically using the Stateless Address Autoconfiguration (SLAAC). The IP address assigned is displayed in the **Network** status page (see page 53) and the **Overview** page (see page 38). Additionally, the user has the option to manually specify DNS servers by selecting the **IPv6 auto configuration (manual DNS)** option and entering DNS server addresses to the **Name server** fields (in hexadecimal notation, e.g.: 2607:f0d0:2001:a::10).

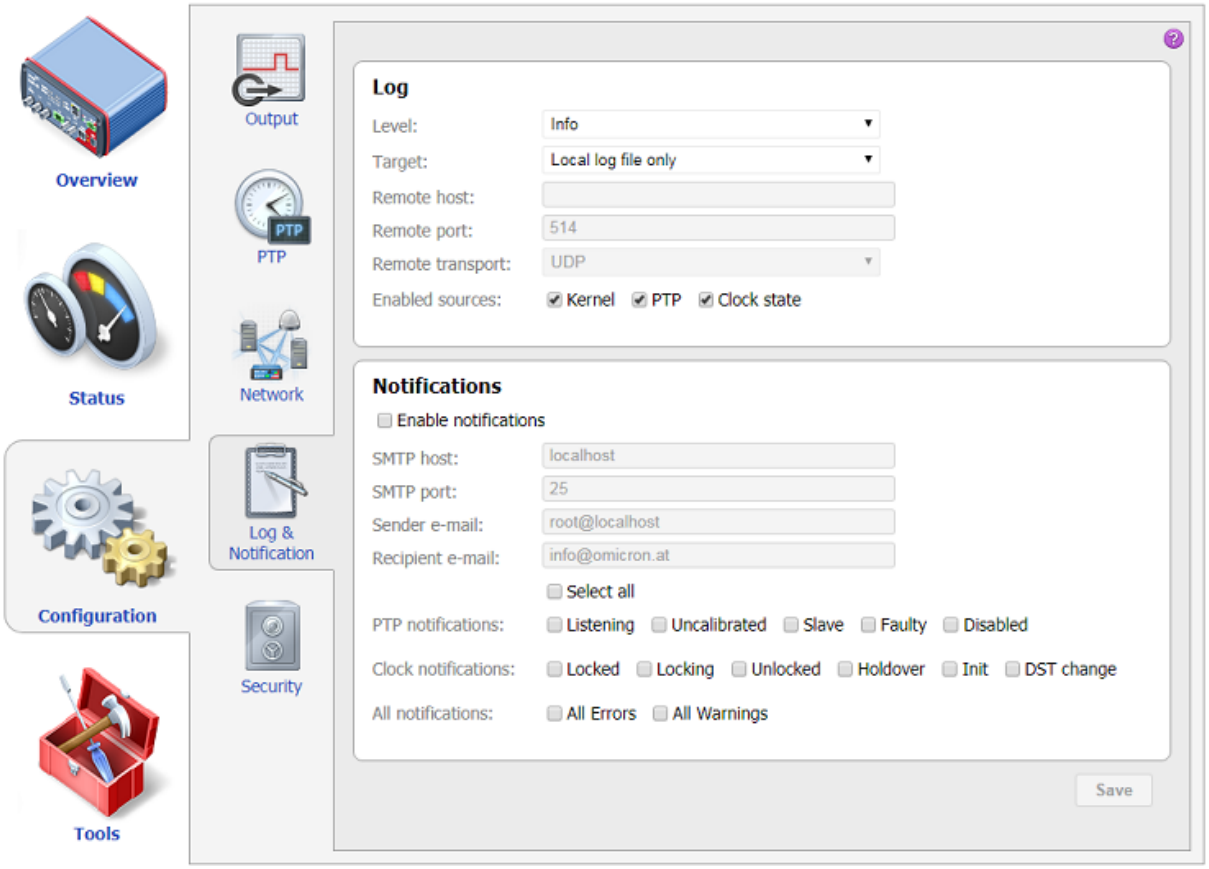
Services pane

Use the check boxes in this pane to enable or disable individual services and processes running on the *TICRO 100* system.

All services are enabled (selected) by default. Disabling services that are not used or required for your specific application will enhance the device security.

Precision Time Protocol (PTP)	Select the check box to enable PTP support (reception of time information via PTP in the network).
OMICRON Device Link	Select the check box to enable the service used by OMICRON *Device Link* to automatically detect OMICRON devices in the network.
Zeroconf	Select the check box to enable detection of your *TICRO 100* device in the network by clients that are able to handle mDNS/DNS-SD (e.g., the Apple Bonjour tool).
File Transfer Protocol (FTP)	Select the check box to enable access via FTP. *TICRO 100* is able to provide FTP server functionality, which can be used for example to transfer a configuration file to *TICRO 100*.
Trivial File Transfer Protocol (TFTP)	Select the check box to enable access via TFTP. *TICRO 100* is able to provide TFTP server functionality, which can be used for example to download a configuration file from *TICRO 100*.

8.3.4 Log & Notification configuration page



The log and notification configuration parameters and settings are explained in the subsections below.

Click the **Save** button to save and apply your changes to *TICRO 100*.

Log pane

Level	Use this list box to select the level as of which you want to have system messages logged to the selected target. Lower levels include the messages of higher levels. The following levels are available (starting from the lowest level): Debug, Info, Warning, Error, Critical.
Target	Use this list box to select the target where you want to have the system messages logged to: **Local logfile only**: Logging is performed to the internal log file that can be viewed using the **Log Viewer** page (see page 55) in the **Status** section. **IPv4 syslog server** and **IPv6 syslog server**: Logging is performed to the internal log file and to the specified syslog server for IPv4 or IPv6 installed in the network.

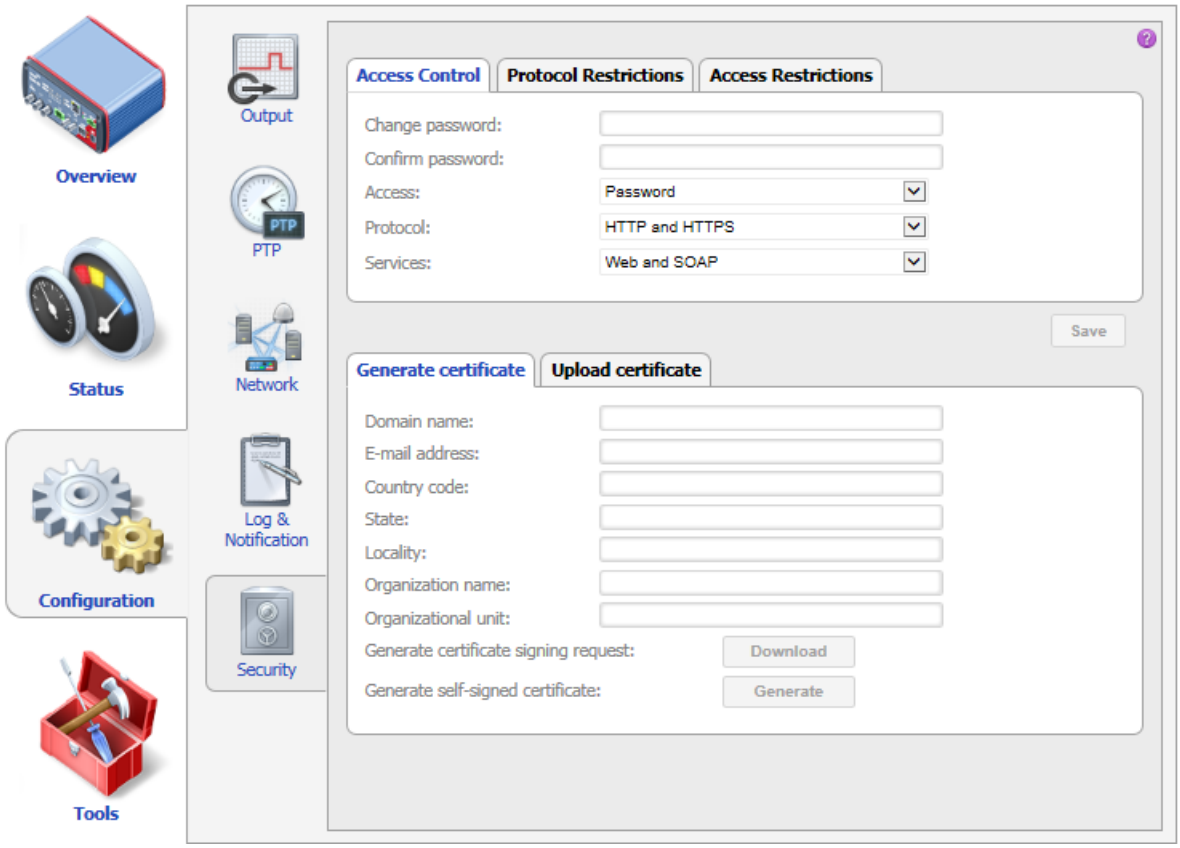
Remote host & Remote port	Use these fields to specify the host name and port number of the syslog server in the network used as log target for the system messages. Only active if the **Target** list box is set to **IPv4/IPv6 syslog server**.
Remote transport	Use this field to specify the network transport protocol of the IPv4 or IPv6 syslog server, if selected in the **Target** field. Select UDP (User Datagram Protocol) or TCP (Transmission Control Protocol).
Enabled sources	Select the corresponding check box to enable logging for a particular message type (Kernel messages, PTP messages and/or clock state messages).

Notifications pane

The event notification function can be used to generate e-mail messages on the occurrence of specific events.

Enable notifications	Select the check box to enable the event notification function and activate the fields and controls in this tab.
SMTP host & SMTP port	Use these fields to specify the host name and port number of the SMTP (e-mail) server.
Sender e-mail	Use this field to specify the e-mail address of *TICRO 100*.
Recipient e-mail	Use this field to specify the recipient e-mail address for the event notification messages.
PTP notifications Clock notifications All notifications	Select the corresponding check box to enable e-mail notification for a specific event or select **Select all** to select all check boxes. **PTP notifications**: Listening, Uncalibrated, Slave, Faulty and Disabled. Send e-mail notification if the PTP state changed to the corresponding state. For more information about the clock states, please refer to the **PTP status page** (see page 47). **Clock notifications**: • Locked, Locking, Unlocked, Holdover, Init, DST change: Send an e-mail notification if the clock state changed to the corresponding state. For more information about the clock states, please refer to the **Output status page** (see page 43). • DST change: Send an e-mail notification with every daylight saving time changeover. **All notifications**: All Errors, All Warnings. Send an e-mail notification for each error and/or warning.

8.3.5 Security configuration page



The security configuration settings are organized in several tabs. They are explained in the subsections below.

Click the **Save** button to save and apply your changes to *TICRO 100*.

Access Control tab

Use this tab to define password protection for accessing *TICRO 100*.

Change password	Enter your password for accessing *TICRO 100*. *TICRO 100* uses the same password for all services and processes running on *TICRO 100* (e.g., detection by OMICRON OMFIND service, FTP access, etc.) The password is case sensitive and must have at least 5 characters (letters, figures or special characters).
Confirm password	Repeat your password for confirmation.

Access	Select **Anonymous** for unrestricted access to the *TICRO 100* Web Interface without password protection. Select **Password** to protect *TICRO 100* against unauthorized access by specifying a password. If password protection is enabled, a login dialog appears when accessing the *TICRO 100* Web Interface. Select **Read-Only** to allow unrestricted access to the **Overview** and the **Status** section of the *TICRO 100* Web Interface, and to protect the **Configuration** and the **Tools** section against unauthorized access by specifying a password. If read-only access is enabled, a login dialog appears when accessing the **Configuration** section or the **Tools** section of the *TICRO 100* Web Interface.  If you set the **Access** field to **Password** or **Read-Only** without defining a password, the default password *timeterminal* is used.
Protocol	Select **HTTP and HTTPs** if you want to allow access to the *TICRO 100* Web Interface via the HTTP protocol or the secure HTTPs protocol. Select **HTTPs only** if you want to allow access via the secure HTTPs protocol only.
Services	Select **Web only** to allow access via the Web Interface only or **SOAP only** if you want to allow access via the Application Programming Interface API only (see section Application Programming Interface (API) on page 82 for more information). Or select **Web and SOAP** to allow access via both interfaces.

 Perform a factory reset on the device if you forgot your password (see Operating Procedures Performed Directly on the Device on page 34). This will reset and deactivate password protection for *TICRO 100*.

Protocol Restrictions tab

Use this tab to increase security if you are using *TICRO 100* in a network with high security demands. Deselecting services that are not required or used for operation makes *TICRO 100* safer against any kind of attacks. Deselecting all options will minimize potential points of attack and thus provide highest security.

Click the corresponding check box to select or deselect an option. All options are selected by default. Click the **Save** button to save and apply your protocol restrictions settings to *TICRO 100*.

Allow OMFIND network configuration	The OMFIND service is used by OMICRON *Device Browser* (the predecessor of *Device Link*) to automatically detect OMICRON devices in the network. However, OMICRON *Device Browser* also allows for changing the IP address of OMICRON devices available in the network. Deselect this option to prohibit IP address changes via OMICRON *Device Browser*. If selected, changing the IP address via OMICRON *Device Browser* is possible.

Allow SSH password login	If this option is enabled, the user can log in to *TICRO 100* via SSH using the standard user/password authentication (i.e., using the user name and password defined for *TICRO 100*) or using a public/private key pair previously generated by the user and copied to *TICRO 100*. Deselect this option to prohibit standard user/password authenticated access to *TICRO 100* via secure shell (SSH). When deselected, access via SSH is only possible via key based authentication. Deselecting this option reduces the risk of unauthorized access to *TICRO 100* through brute force attacks.  There are numerous instructions for generating SSH key pairs available on the Internet.

Access Restrictions tab

Select the **Block Ethernet Access via USB** check box to disable access to *TICRO 100* via the USB interface of the device. Click the **Save** button to save and apply your setting to *TICRO 100*.

Generate Certificate tab

When accessing *TICRO 100* via HTTPS, an "untrusted connection" message will appear because *TICRO 100* does not have a valid certificate.

To avoid such messages, it is necessary to provide the *TICRO 100* with such a certificate. There are two possible ways: Generating a certificate signed by an accredited certification authority or generating a certificate signed by yourself.

Web browsers usually contain the digital signatures of all accredited certification authorities by default and will therefore accept certificates signed by those authorities. However, when using a self-signed certificate, the web browser will not recognize you as a valid certification authority (since it does not know the signature of "your" certification authority) and thus not accept such certificates. This behavior can only be eliminated by providing each web browser used to access *TICRO 100* with the digital signature of "your" certification authority. Due to this, generating a self-signed certificate will in most cases not be a feasible solution in practice. We recommend to generate a certificate signed by an accredited certification authority or to accept the "untrusted connection" message displayed when accessing *TICRO 100*.

Proceed as follows to generate a certificate signed by an accredited certification authority:

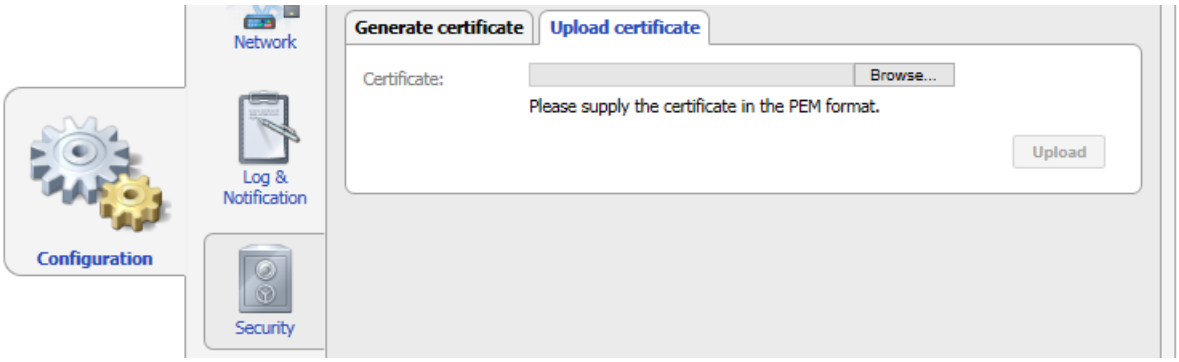
1. Enter the required information to the fields **Domain name**, **E-mail address**, **Country code** (e.g., AT), **State**, **Locality**, **Organization name** and **Organizational unit**.
2. Click the **Download** button next to **Generate certificate signing request** to generate a certificate and download it from *TICRO 100*.
3. Send the certificate to an accredited certification authority.
4. Upload the signed certificate received from the certification authority to *TICRO 100* using the **Upload Certificate** tab (see below).
5. The web browser will then recognize that the certificate has been signed by an accredited certification authority and therefore no longer display the "untrusted connection" message when accessing *TICRO 100*.

Proceed as follows to generate a self-signed certificate:

1. Enter the required information to the fields **Domain name**, **E-mail address**, **Country code** (e.g., AT), **State**, **Locality**, **Organization name** and **Organizational unit**.
2. Click the **Generate** button next to **Generate self-signed certificate** to generate a certificate on *TICRO 100* that is signed by yourself.
3. Select **HTTPs only** for the **Protocol** option in the **Access Control** tab and click the **Save** button.
4. *TICRO 100* automatically performs a restart of the web server.
5. The web browser then displays an "untrusted connection" message. Add the certificate previously generated for your *TICRO 100* to your web browser.

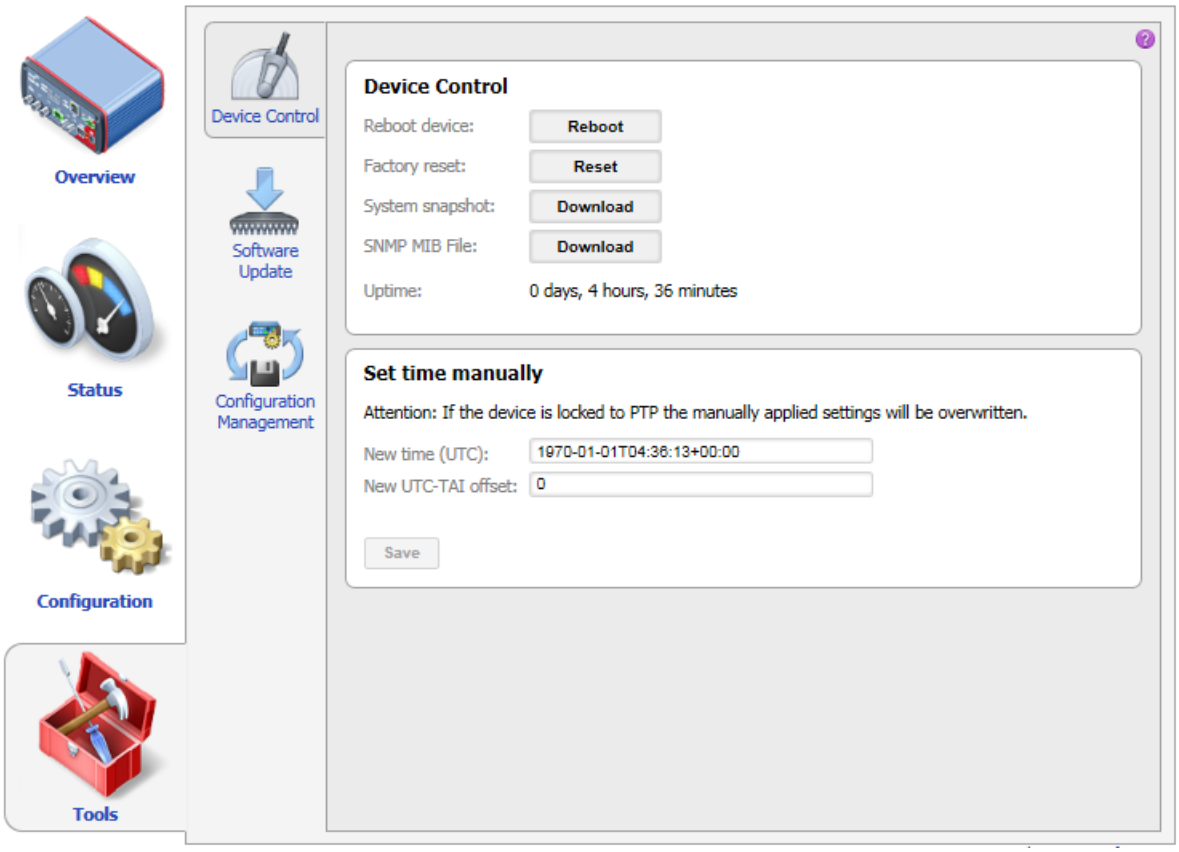
The approach to add the certificate to the web browser strongly depends on the browser used to access *TICRO 100*. Please consult the help system of your web browser for a detailed description how to handle certificates with your browser.

Upload Certificate tab



Click the **Browse...** button to navigate to the signed certificate (see above). The path and file name is displayed in the **Certificate** field after selecting it in the file open dialog. Then click the **Upload** button to upload the certificate to your *TICRO 100*.

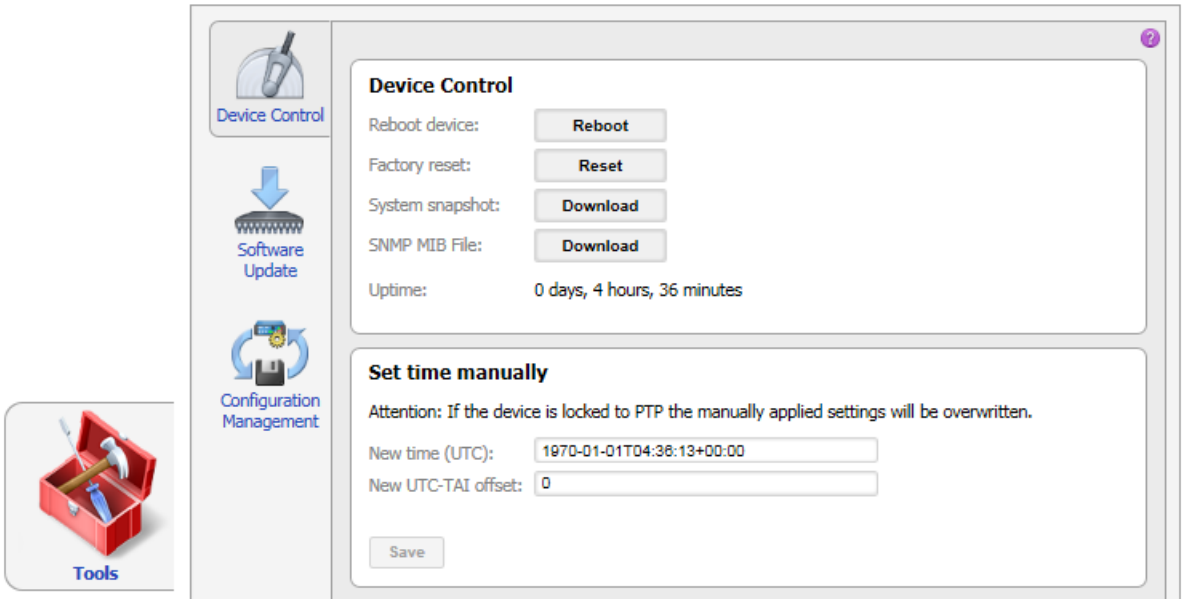
8.4 Tools section



The following pages are available in the **Tools** section:

- **Device Control** (see page 78)
- **Software Update** (see page 80)
- **Configuration Management** (see page 81)

8.4.1 Device Control page



The device control functions are explained below.

Device Control pane

Reboot device	Click the **Reboot** button to initiate a device reboot. A reboot can also be performed using the pushbutton on the device (see section Performing a reboot of TICRO 100 on page 34).
Factory reset	Click the **Reset** button to initiate a factory reset in order to reset the device configuration to the factory defaults. The factory reset deletes all user specific settings. A factory reset can also be performed using the pushbutton on the device (see section Performing a factory reset on page 35).  Performing a factory reset may possibly result in an IP address change of *TICRO 100* due to automatic IP address assignment by a DHCP server.
System snapshot	Click the **Download** button to download a system snapshot containing all configuration settings and the log file. The system snapshot contains important information for the technical support in case of problems. Downloading a system snapshot may take approx. 30 seconds.
SNMP MIB File	A MIB (Management Information Base) file is required for proper representation of the power profile settings of *TICRO 100* in SNMP clients. Click the **Download** button to download the MIB file from *TICRO 100*. *Only available for PTP profile Power (C37.238-2011).*
Uptime	Displays the time *TICRO 100* is in operation since the last power-up.

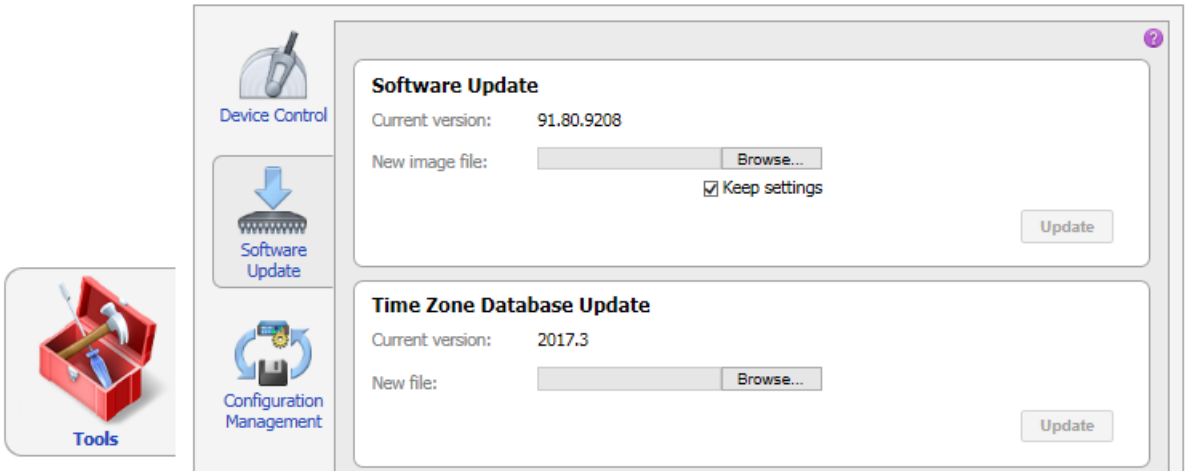
Set time manually pane

Use these fields to set the time of the internal clock manually. Click the **Save** button to apply your clock settings to *TICRO 100*.

Setting the time manually is only required and possible if *TICRO 100* does not receive time with sufficient accuracy via PTP. The manual time settings are overwritten by the PTP time information as soon as *TICRO 100* locks to a PTP time signal.

New time (UTC)	Click this field to open a calendar dialog allowing for the selection of the current date and time. In this dialog, set the date and time or click **Now** to set it to the current date and time of your computer. Click **Done** to close the calendar and to apply your time settings to the **New time (UTC)** field.
New UTC-TAI offset	Leap seconds are occasionally applied to UTC time in order to keep its time of day close to the mean solar time. The latest insertion of a leap second was done in December 2016 to increase the actual offset of TAI to UTC to 37 seconds. Enter this offset to the **New UTC-TAI offset** field.  The insertion of leap seconds is decided by the International Earth Rotation and Reference Systems Service (IERS) and performed irregularly in unpredictable spaces of some years. If necessary, please investigate on the Internet for the actual TAI-UTC offset valid at the time of reading. The TAI-UTC offset is adjusted automatically as soon as *TICRO 100* locks to a PTP signal. In this case, a previously entered manual setting is overwritten.

8.4.2 Software Update page



Software Update pane

To perform a software update for *TICRO 100*, select the software image file and click the **Update** button to start the software update.

The update process may take several minutes. Do not disconnect *TICRO 100* from the power supply or from the Ethernet or USB connection during this process. *TICRO 100* automatically restarts after a software update.

Current version	Displays the version number of the software currenty installed on *TICRO 100*.
New image file	Click the **Browse...** button to navigate to the software image file. The path and file name is displayed in the field after selecting it in the file open dialog.
Keep settings	If this check box is selected, the user specific configuration settings are kept during a software update. Deselect the check box to automatically reset the device configuration to the factory defaults after a software update.

If the software update process fails due to any reason, *TICRO 100* will enter a recovery mode on the next power-up. In this mode, the device provides only a rudimentary Web Interface (similar to the **Software Upgrade** page) just allowing for the upload of a software image.

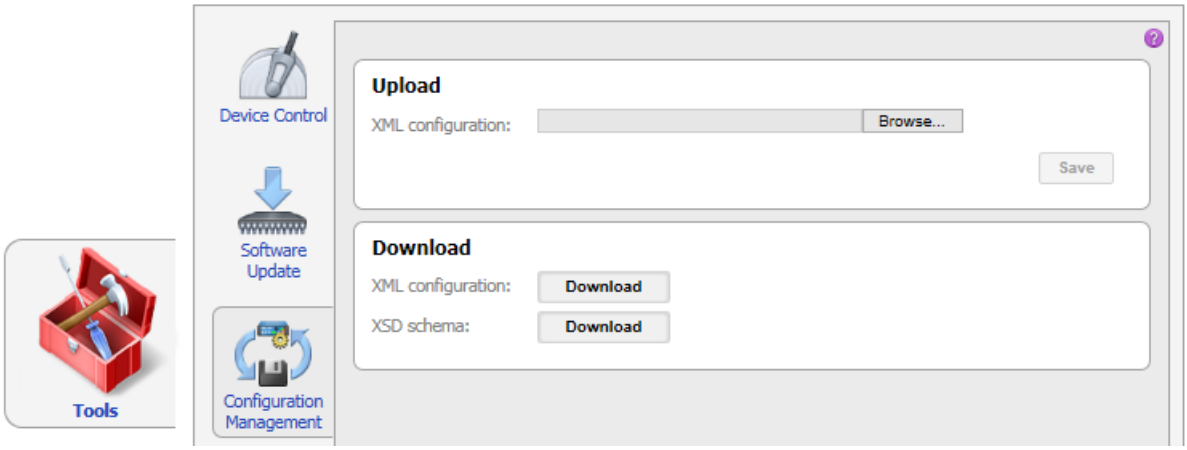
Timezone Database Update pane

The timezones offered in the clock settings (see **Current timezone** field in the **Clock settings** pane of the **Output** configuration page on page 61) are defined in a timezone database stored on *TICRO 100*. In case you need to get a new version of the time zone database, please send an email to the OMICRON Lab Technical Support (support@omicron-lab.com). They will generate an up-to-date timezone database on request.

To perform a timezone database update, select the database file received from OMICRON Lab and click the **Update** button to start the update.

Current version	Displays the version number of the timezone database currenty installed on *TICRO 100*.
New file	Click the **Browse...** button to navigate to the timezone database file. The path and file name is displayed in the field after selecting it in the file open dialog.

8.4.3 Configuration Management page



Upload pane

XML configuration	Use this function to upload a prepared configuration file to *TICRO 100* and apply this configuration on the device. Click the **Browse...** button to navigate to the XML configuration file. The path and file name is displayed in the field after selecting it in the file open dialog. Click the **Save** button to upload and save the configuration file to *TICRO 100*.

Download pane

XML configuration	Click the **Download** button next to **XML configuration** to download the current configuration of *TICRO 100* in XML format.
XSD	Click the **Download** button next to **XSD** to download the XML Schema Definition defining the XML structure of the XML configuration file from *TICRO 100*.

9 Application Programming Interface (API)

TICRO 100 can also be controlled and configured via an application programming interface (API). Via this API all the functions of the device can be controlled, except the following:

- Update of the internal software
- Download of the configuration as XML or the schema definition as XSD
- Upload of a XML configuration file
- Upload or creation of certificates

To execute these tasks, please use the functions available in the **Tools** section and the **Security** page of the **Configuration** section in the Web Interface.

This API is accessible via a SOAP interface offered by the webserver of the device. This means every SOAP compatible system and/or language can be used to create an application to control or configure the device.

Pre-generated libraries and examples for different languages can be found at www.omicron-lab.com by visiting the download area in the *TICRO 100* section.

This interface can be accessed at `[HTTP/HTTPS]://[DeviceIP/Hostname]/Api/Process`. The WSDL file to create a service proxy can be requested at `[HTTP/HTTPS]://[DeviceIP/Hostname]/Api/Wsdl`.
Please note that the URLs are case sensitive.

A short example usage is shown below. For a more detailed explanation, please download the extended API documentation which can be found at the same location as the examples at the link above or at `[HTTP/HTTPS]://[DeviceIP/Hostname]/Help/Api`.

```
//TICRO web server does not support the headers otherwise
System.Net.ServicePointManager.Expect100Continue = false;

var service = new ApiClient();
string status = service.Status(); // or "string status = await service.StatusAsync();"
Debug.WriteLine("Device status: " + status); //prints "Device status: OK"
```

The "ApiClient" proxy class was generated by the "Add Service Reference…" wizard using Microsoft® Visual Studio.

10 OMICRON Device Link

Using OMICRON *Device Link* it is possible to access network compatible OMICRON devices. OMICRON *Device Link* automatically finds all OMICRON and OMICRON Lab devices available in the computer network.

For a detailed description of OMICRON *Device Link*, please refer to the OMICRON *Device Link* help. To display the help, launch OMICRON *Device Link* and then press the **F1** key on your keyboard, or click the symbol on the top right and select **Help**.

10.1 Installing OMICRON Device Link

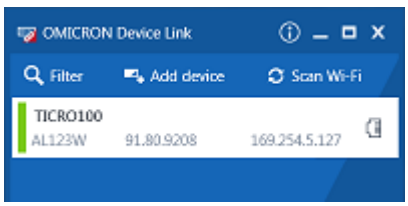
OMICRON *Device Link* and its installation program Setup Wizard are included on the CD ROM accompanying *TICRO 100*. The content of the CD ROM is also available for download at www.omicron-lab.com. Proceed as follows to install OMICRON *Device Link*:

1. Exit all other major programs running on your computer.
2. Insert the CD ROM into your computer's CD ROM drive and click **Install Device Link** on the start page. Should the start page not be displayed automatically a few seconds after the CD has been inserted into the CD ROM drive, change to the Windows Explorer and double-click autorun.exe on the CD ROM.
3. Follow the instructions displayed on the screen to install the software.

10.2 Accessing the TICRO 100 Web Interface

Proceed as follows to access the *TICRO 100* Web Interface using OMICRON *Device Link*:

1. Launch OMICRON *Device Link*.
2. OMICRON *Device Link* will automatically find and display your *TICRO 100*.



The vertical bar on the left displays the device status:

- Green bar: The device is online and ready for operation.
- Gray bar: The device is offline. Supply your *TICRO 100* with power.
- Red bar: The device is online but not accessible due to incorrect IP configuration.

Usually *TICRO 100* is configured to obtain the IP address automatically. However, it is also possible to assign a static IP address to *TICRO 100*. In this case, the following behavior applies: When accessing *TICRO 100* via Ethernet, OMICRON *Device Link* will find the *TICRO 100*, but display a red bar to indicate that the device cannot be accessed.

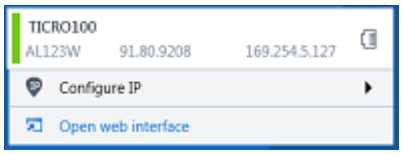
► Click the *TICRO 100* entry and select **Configure IP**.

OMICRON *Device Link* will then display an IP configuration page. In this page, select **Use the following IP address** and enter the IP address of your *TICRO 100*, or enter an IP address of your choice to assign a new IP adress to your *TICRO 100*. Click the **Subnet mask** field to automatically fill a subnet mask and then click **Apply** to connect to *TICRO 100*.

Or

► Click the **Add device** button and enter the IP address assigned to *TICRO 100*.

3. A green vertical bar indicates that OMICRON *Device Link* successfully connected to your *TICRO 100*. Click the *TICRO 100* entry and select **Open Web Interface**.



4. The start page of the *TICRO 100* Web Interface is displayed in a web browser.

11 Technical data

You can find more detailed technical data on the OMICRON Lab web site www.omicron-lab.com.

11.1 Timing performance

Characteristic	Specification
Timing accuracy	PTP time stamping resolution: 8 ns Hold-over drift in 24 hours after 48 hours of operation and at least 1 hour in the Locked state (at constant temperature; the drift depends on the installed oscillator option): • Standard oscillator **OCXO-100**: < 100 µs (order no.: OL000310, *TICRO 100* with OCXO-100) • High-precision oscillator **OCXO-25**: < 25 µs (order no.: OL000311, *TICRO 100* with OCXO-25) The installed oscillator option is stated on the type plate on the bottom side of the device.
Supported timing protocol	PTP according to IEEE 1588-2008 (IEEE 1588 version 2).
PTP features	Default profiles according to IEEE 1588-2008 Annex J: • End-to-end (multicast) and peer-to-peer delay mechanisms • PTP over UDP/IPv4, UDP/IPv6 and Ethernet/IEEE 802.3 (IEEE 1588-2008 Annex D, E, and F) Power profiles according to IEEE C37.238-2011 and IEEE C37.238-2017 (IEEE Standard Profile for Use of IEEE 1588 Precision Time Protocol in Power System Applications). Power Utility profile according to IEC 61850-9-3:2016 (Precision Time Protocol profile for power utility automation).

11.2 Power supply

Possible methods of power supply:

- Power supply via Power over Ethernet
- Power supply via the plug-in power supply unit provided on delivery (rear panel DC input socket)
- Power supply via a suitable external DC supply voltage (front panel DC input socket)

TICRO 100 may be supplied using only one of these power supply options or using a combination of two or all three methods to provide power supply redundancy (see also chapter Power Supply on page 22).

If supplied via the rear panel DC power input socket and/or via the front panel DC power input socket, *TICRO 100* is also able to act as a power sourcing equipment (PSE) for class 1 devices (< 4 W) according to IEEE 802.3af.

<table>
<tr><th>Characteristic</th><th>Specification</th></tr>
<tr><td>Power over Ethernet (PoE)</td><td>Class 3 powered device (PD) according to IEEE 802.3af.
Max. power consumption: 13 W</td></tr>
<tr><td>Front panel DC power input socket</td><td>MC 1.5/2-STF-3.81. Terminal block supplied on delivery. Polarity printed on the front plate.
Supply voltage: 18 ... 57 VDC
Max. power consumption: 15 W
Max. conductor cross section: 1.5 mm^2.
 
WARNING
Death or severe injury caused by high voltages possible.
► Use a power supply unit that complies with the SELV standard if product safety according to IEC 61010-1 and IEC 60255-27 is required. The plug-in power supply unit supplied on delivery complies with the SELV standard.</td></tr>
<tr><td>Rear panel DC power input socket</td><td>Barrel connector for power supply unit supplied on delivery.
Standard DC barrel jack 2.5 x 5.5 x 11 mm, center pin positive.
Supply voltage: 18 ... 57 VDC
Max. power consumption: 15 W
 
WARNING
Death or severe injury caused by high voltages possible.
► Use a power supply unit that complies with the SELV standard if product safety according to IEC 61010-1 and IEC 60255-27 is required. The plug-in power supply unit supplied on delivery complies with the SELV standard.
NOTICE
Equipment damage caused by overvoltage possible.
The DC power input socket on the rear side does not fulfill the surge requirements of IEC 60255-27.
► Use the DC power input socket on the front side if IEC 60255-27 compliance is required.</td></tr>
</table>

11.3 Frequency outputs and time codes

Electrical specifications

WARNING

Death or severe injury caused by high voltages possible.

All inputs and outputs of *TICRO 100* are electrically connected to the SELV (safety extra low voltage) insulation group of the device.

► Do not connect any voltages that are not SELV compliant.

Output	Specification
10 MHz	50 Ω BNC socket for 10 MHz sine wave signal. Not configurable. 4 dBm ± 2 dB at 50 Ω load. Short-circuit protected. Ground connected to housing.
Out 1, Out 2	Configurable 50 Ω BNC outputs. Unmodulated time codes: 2.5 V at 50 Ω load, 5 V at open circuit. TTL compatible. Modulated IRIG-B: 3 V amplitude (peak) at 50 Ω load, 6 V amplitude at open circuit. Short-circuit protected. Ground connected to housing.
Out 3	Configurable optocoupler output (MSTB 2,5 HC/ 2-STF-5,08 screw terminal, connector supplied on delivery). Maximum collector-emitter voltage: 30 V Maximum current: 100 mA Supports digital (unmodulated) time codes only.
Out 4, Out 5	Configurable optical ST connector outputs. 820 nm wave length. Supports digital (unmodulated) time codes only.

Supported time codes

Time code	Description
IRIG-B	TAI, UTC or local time base. IRIG-B 00x (unmodulated) or IRIG-B 12x (modulated on 1 kHz carrier). Coded expressions: control functions, straight binary seconds, BCD_{year}.
DCF77	Unmodulated. Always CET/CEST.

Time code	Description
PPX	TAI, UTC or local time base. 1, 10, 100 or 1000 PPS (pulses per second), 1 PPM (pulse per minute), 1 PPH (pulse per hour), and user definable pulse frequency between 10 mHz and 1 MHz (or 2.048 MHz with "Enable high frequency PPX mode" option enabled). Time reference: Falling or rising edge. Can be combined with Trigger.
Trigger	TAI, UTC or local time base. 1 pulse at a predefined point in time or PPX sequence starting at a defined point in time. Absolute trigger date and time programmable with 1 s resolution.

11.4 Networking and management

Characteristic	Specification
Management	Configuration and management via Web Interface (HTTP/HTTPS). TFTP, FTP and SSH access. Automated configuration via SSH, SOAP and XML files. Failsafe software upgrade in the field. Email notifications and syslog functionality (local and remote).
Networking	Twisted-pair (10BaseT/100BaseTX, RJ45) and optical (100BaseFX, LC multimode) Ethernet connectors. One network interface useable at a time. IPv4 and IPv6 support. Power over Ethernet according to IEEE 802.3af. DHCP. Zeroconf (MDNS/DNS-SD).
USB	USB 2.0 (type B) connector. USB network gadget (RNDIS). Allows network connection to the *TICRO 100* and devices connected to the Ethernet interface of *TICRO 100*.

11.5 Environmental conditions

Characteristic	Specification
Temperature range	
Operation	-20 °C to +50 °C (-4 °F to +122 °F)
Storage	-40 °C to +85 °C (-40 °F to +185 °F)

11.6 Mechanical specifications

Characteristic	Specification
Dimensions H x W x D	Dimensions without any connectors plugged in and without DIN rail clip: 54.6 x 171.6 x 121 mm / 2.15 " x 6.75 " x 4.76 "
Weight	< 750 g / < 1.65 lbs

11.7 Standards

Electromagnetic compatibility (EMC)	
General	Radiated emissions according to EN 61326-1, CISPR 11, IEC 60255-25, EN 55022, class A. Radiated emissions according to FCC part 15 class A. Radiated immunity according to EN 61326-1, EN 61000-4-3, IEC 60255-22-3. ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.
Back panel DC power input socket	Conducted immunity continuous wave according to EN 61326-1, EN 61000-4-6, IEC 60255-22-6. EFT (Burst) according to EN 61326-1, EN 61000-4-4, IEC 60255-22-4. Surge according to EN 61326-1, EN 61000-4-5, IEC 60255-22-5. ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.
Front panel DC power input socket	Conducted immunity continuous wave according to EN 61326-1, EN 61000-4-6, IEC 60255-22-6. EFT (Burst) according to EN 61326-1, EN 61000-4-4, IEC 60255-22-4. Surge according to EN 55024, EN 61000-4-5. ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.
RJ45 Ethernet port	Conducted emission according to EN 55022, IEC 60255-25, class A. Conducted immunity continuous wave according to EN 61326-1, EN 61000-4-6, IEC 60255-22-6. EFT (Burst) according to EN 61326-1, EN 61000-4-4, IEC 60255-22-4. Surge according to EN 61326-1, EN 61000-4-5, IEC 60255-22-5. ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.
FIBER Ethernet port	ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.
10 MHz output, Out 1, Out 2, Out 3	Conducted immunity continuous wave according to EN 61326-1, EN 61000-4-6, IEC 60255-22-6. EFT (Burst) according to EN 61326-1, EN 61000-4-4, IEC 60255-22-4. ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.
Out 4, Out 5	ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.

Electromagnetic compatibility (EMC)	
USB port	Conducted immunity continuous wave according to EN 61326-1, EN 61000-4-6, IEC 60255-22-6. EFT (Burst) according to EN 61326-1, EN 61000-4-4, EN 55024. ESD according to EN 61326-1, EN 61000-4-2, IEC 60255-22-2.

Certified safety standards	
Safety	IEC 60950, IEC 61010, IEC 60255

Other	
Shock	Tested according to IEC 60068-2-27 and IEC 60255-21-2 (class 1). Response: 5 g / 11 ms; half-sinusoid; 3 pulses in each direction; 6 directions. Withstand: 15 g / 11 ms; half-sinusoid; 3 pulses in each direction; 6 directions. Bump test: 10 g / 16 ms; half-sinusoid; 1000 pulses in each direction; 6 directions.
Vibration	Tested according to IEC 60068-2-6 and IEC 60255-21-1 (class 1). Response: frequency range 10 ... 150 Hz; 0.5 g; 1 sweep cycle per axis. Endurance: frequency range 10 ... 150 Hz; 1 g; 20 sweep cycles per axis.
Humidity	5 % ... 95 % relative humidity; no condensation.
Climate	Tested according to IEC 60068-2-30, Test Db, damp heat, cyclic (6 cycles, 55°C)
Protection class	IP40 according to IEC 60529.

Certificates
Manufactured under an ISO 9001 registered system.

11.8 Cleaning

To clean *TICRO 100*, use a cloth dampened with isopropanol alcohol or water. Prior to cleaning, always unplug all connectors so that all hazardous life parts are disconnected and the device is turned off.

12 Open Source software license information

Parts of *TICRO 100* software are under OMICRON license, other parts are under open source software licenses. To view the license information on the open source software used in *TICRO 100*, please launch the *TICRO 100* Web Interface and click the License Information hyperlink in the bottom right corner.

The used open source components are available for download under http://opensource.omicronenergy.com/TICRO 100.

13 Glossary

BMCA	Best Master Clock Algorithm
CET / CEST	Central European Time / Central European Summer Time
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DNS-SD	DNS Service Discovery
E2E	End-To-End
FTP	File Transfer Protocol
GPS	Global Positioning System
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
IED	Intelligent Electronic Device
IP	Internet Protocol
MAC address	Media Access Control address
mDNS	Multicast DNS (Domain Name System)
MIB	Management Information Base
ODB	OMICRON Device Browser
OMFIND	Protocol for finding devices on an Ethernet network
P2P	Peer-To-Peer
PoE	Power over Ethernet (according to IEEE 802.3af)
PTP	Precision Time Protocol
SCP	Secure Copy
SELV	Safety Extra Low Voltage
SLAAC	Stateless Address Autoconfiguration
SNMP	Simple Network Management Protocol
SSH	Secure Shell
TAI	International Atomic Time
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
UDP	User Datagram Protocol
URL	Uniform Resource Locator
UTC	Universal Time Coordinated
VLAN	Virtual Local Area Network
XML	Extensible Markup Language
XSD	XML Schema Definition

Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you!

24/7 Technical Support - Get Support

www.omicron-lab.com/contact/get-support/

Offering our customers outstanding support is one of our top priorities. At our technical support hotline, you can reach well-educated technicians for all of your questions. Around the clock – competent and free of charge.

Make use of our 24/7 international technical support hotline: **+43 59495 4444**.

Additionally, you can find the OMICRON Service Center or OMICRON Sales Partner closest to you at www.omicron-lab.com.

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