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#### Disclaimer

This manual contains information that is correct to the best of NovaTech's knowledge. It is intended to be a guide and should be used as such. It should not be considered a sole source of technical instruction, replacing good technical judgment, since all possible situations cannot be anticipated. If there is any question as to the installation, configuration, or use of this product, contact NovaTech, LLC at (913) 451-1880.

To ensure that the equipment described in this User's Manual, as well as all equipment connected to and used with it, operates in a satisfactory and safe manner, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since these codes can vary geographically and can change with time, it is the user's responsibility to determine which codes and standards apply, and to comply with them.



**Failure to follow the instructions provided in this manual, and/or failure to comply with applicable codes and safety standards can result in damage to this equipment, damage to connected devices, and/or serious injury to personnel.**

The Kronos Series 3 is not designed nor approved for installation or operation in nuclear facilities.

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The documentation for the Orion and Kronos products is structured as follows.

Manual name (see cover page of each manual)	Purpose
Quick Start Guide	Describes out-of-the-box setup for quick installation.
User Manuals ▪ Kronos Series 2 ▪ Kronos Series 3	<ul style="list-style-type: none"><li>▪ Description of Kronos hardware and hardware options.</li><li>▪ List of software options.</li></ul>

## Styles and Symbols

In this document, fonts, text styles and symbols are used to distinguish standard text from keyboard input, program text, GUI messages, and hyperlinks as follows. Warnings and safety notices are indicated with ANSI symbols.

Displayed text or symbol	Description
This is normal text.	Standard text.
<a href="#">See Access Passwords (Online)</a>	Hyperlink to text in same document.
<a href="http://www.novatechautomation.com">www.novatechautomation.com</a>	Hyperlink to website.
<a href="mailto:support@novatechautomation.com">support@novatechautomation.com</a>	Clicking this link starts email client on the PC.
<i>See Kronos Series 3 User Manual</i>	Document name.
Minimum value	Menu item or text displayed by software.
Name of the data point	Text to be entered in input field or window.
<b>Save</b>	GUI button to be clicked.
if frequency < 60.0 then	Program code.
<Enter>, <Ctrl>+<G>, <G>	Key to be pressed.
	This yellow triangle indicates a warning that must be observed by the users in order to avoid possible equipment damage or personal injury.
	This yellow triangle indicates an electrical hazard.
	Electrostatic sensitive device requires proper handling and grounding procedures to avoid equipment damage.
 <b>DANGER</b>	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

Note that depending on the Windows® display settings on the computer running NCD, some of the screen shot details may appear differently than shown in this manual.

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## 1 Introduction

### 1.1 Product Description

Kronos Series 3 Satellite Clocks are specifically developed for applications in protection, automation, and control of power systems.

These clocks provide GNSS-derived synchronization signals in different formats and protocols for use by, among others, protection relays, phasor-measurement units, revenue meters, fault recorders, and fault locators.

Signals can be distributed over a PTP, NTP, and IRIG-B outputs (coax, twisted pair, fiber optic).

The standard oscillator is TCXO. OCXO is available as an option for better holdover in case of loss of satellites.

A bright dot matrix display on the front of the Kronos clock provides feedback to substation personnel and allows for easy checking of correct configuration of time zone and daylight saving time.

The Kronos clock can be monitored and configured remotely using a web browser.

### 1.2 Key Features

The Kronos clocks offer the following key features:

- Accuracy 20ns (99%, clear sky)
- TCXO (standard, supports GPS, Galileo, and Glonass or BeiDou) or OCXO (optional, supports GPS, and Glonass or BeiDou)
- RJ45 10/100/1000BaseT port for configuration and monitoring (port eth0)
- Four SFP slots for copper or fiber transceivers
- Timing signal generators for IRIG-B, PPS, and PPM signals
- Up to three output cards (unmodulated, modulated, optical fiber)
- PTP and NTP
- Supported PTP profiles
  - Default - UDPv4
  - Default - 802.3
  - IEEE C37.238-2011 (Power Profile)
  - IEEE C37.238-2017 (Power Profile)
  - IEC 61850-9-3:2016 (Utility Profile)
  - Telecom G.8265.1 (Frequency Synchronization)
  - Telecom G.8275.1 (Phase/time synchronization with full timing support from the network)
  - Telecom G.8275.2 (Phase/time synchronization with partial timing support from the network)
  - Custom
- Built-in SNMP agent, with trap generation
- Syslog
- Form C alarm dry contact
- Antenna cable delay compensation
- User-configurable rules for daylight saving time (DST)
- Leap second announcement
- Redundant power supply option
- 19" rack mount

### 1.3 Firmware Versions

The firmware revision is displayed on the unit's dot matrix display for a few seconds immediately after power up. Firmware can be updated as described in sections [Upload \(Online\)](#) for update via webpage and [Appendix D – Firmware Update Procedure](#) for update via SFTP.

## 2 Installation

### 2.1 Rear Panel

Refer to your clock's part number and to the information in [Appendix A – Options List](#) to determine the installed options. The label on the back of the clock shows the particular configuration of the clock and can be used to determine the correct allocation of all ports and signals.

### 2.2 Mounting

Kronos clocks are designed to be mounted in a 19" rack using four M6x15 screws (not included).

#### 2.2.1 Clearances

Allow adequate clearance for all connections on the rear panel. Make sure that the clearances provided for the antenna cable respect the specified minimum bending radius. Minimum bending radius depends on the cable used. See cable specifications for details.

**Note:** If the minimum bending radius of the antenna cable is not observed, its impedance might be altered which may compromise the unit's performance.

#### 2.2.2 Environment

**Note:** Make sure that temperatures inside the cabinet do not exceed the limits stated in [Table 39](#). Appropriate heating or cooling measures must be provided to guarantee that this requirement is met at all times. Also, air humidity should comply with the limits described in [Table 39](#).

### 2.3 Power Connections

There are two power supply options available for Kronos clocks, a wide range and a low voltage option.

#### **WARNING**



Make sure that the voltage provided by the power source is within the limits specified in [Table 37](#). Do not proceed with the installation until you are sure that the correct power source is being used.

All power connections should use 16 AWG (1.5mm<sup>2</sup>) insulated flameproof flexible cables and use the screw terminals supplied with the clock. To reduce the risk of electrical shock, pre-insulated pin terminals should be used on the ends of the power connections.

If using a clock with redundant power supplies, repeat the above steps for the second power supply.

**⚠️WARNING**

A 16 AWG (1.5mm<sup>2</sup>) ground lead shall be connected to the terminal marked with the protective ground symbol to protect the operator against the risk of electrical shock.

### 2.3.1 Fusing Requirements

**⚠️WARNING**

If compliance with IEC 61010 is required, install an external bipolar circuit breaker or switch near the clock so that both current-carrying conductors of the power supply are interrupted. DO NOT interrupt the protective ground conductor.

The use of a 10A, category C, IEC 60947-2 compliant, bipolar circuit breaker with an interruption capacity of at least 25kA is recommended.

If using a clock with redundant power supplies, use a separate circuit breaker or switch for the wiring of the second power supply.

### 2.3.2 Grounding

For optimal electromagnetic compatibility, use a grounding wire with at least 10 AWG (6mm<sup>2</sup>) cross section to connect the grounding bolt at the rear panel of the clock to a good ground point on the mounting cabinet.

## 2.4 Antenna Installation

Clocks require an active antenna in order to track satellites. NovaTech recommends using the antenna with TNC connector (50Ohm) available from NovaTech (see section [Antenna](#)), but any other active antenna that can be powered with 4.5V dc and 100mA maximum consumption can be used. It is also possible to use antennas with F-type connectors (75Ohm) with the option -F75. Contact NovaTech for further information if you wish to use a different antenna.

### 2.4.1 Antenna Location

Mount the antenna outdoors, with the radome pointing skywards and with an unobstructed view of the sky. As far as possible, mount the antenna above any surrounding buildings.

**Note:** A partially obstructed sky view might delay or even prevent the initial satellite fix required to start operation of the clock.

### 2.4.2 Antenna Mounting

The NovaTech antenna mount is described in section [Antenna](#).

### 2.4.3 Antenna Cables

Series 3 is available with two antenna port options:

- Standard: only TNC antenna port (50Ohm).
- Option -F75: TNC antenna port (50Ohm) and F-type port (75Ohm) next to the TNC port.



**If the -F75 option is installed, connect only the TNC cable or the F-type cable to the respective port. DO NOT connect two antennas to the clock.**

**Note:** The antenna cable should be routed through a conduit to shield from rain and/or solar irradiation. The conduit should not be shared with any power cabling.

Total cable attenuation should be less than 40dB which can be determined from the cable length and the attenuation per foot.

### 2.4.4 Surge Arrester

To avoid lightning damages to the clock, a gas discharge surge arrester is included with Kronos and must be installed at the building or cabinet entrance. See also section [Surge Arrester](#).

**Note:** Mount the surge arrester using a 'L' shaped bracket and ground it using a cable with a cross section of at least 10 AWG (6mm<sup>2</sup>). Use the same ground point as the clock to avoid ground-rise-potential damage.

## 2.5 IRIG-B Cables

Twisted pair and coax cabling for connecting the IEDs to the clock output cards must be wired as follows:

- One main cable.
- Short connections to IEDs.
- Termination resistor at the end. The terminator should match the impedance of the cable being used, which is 50 Ohm for coax, and 100 to 200 Ohm for twisted pair.

See also the following figure for best installation practices.

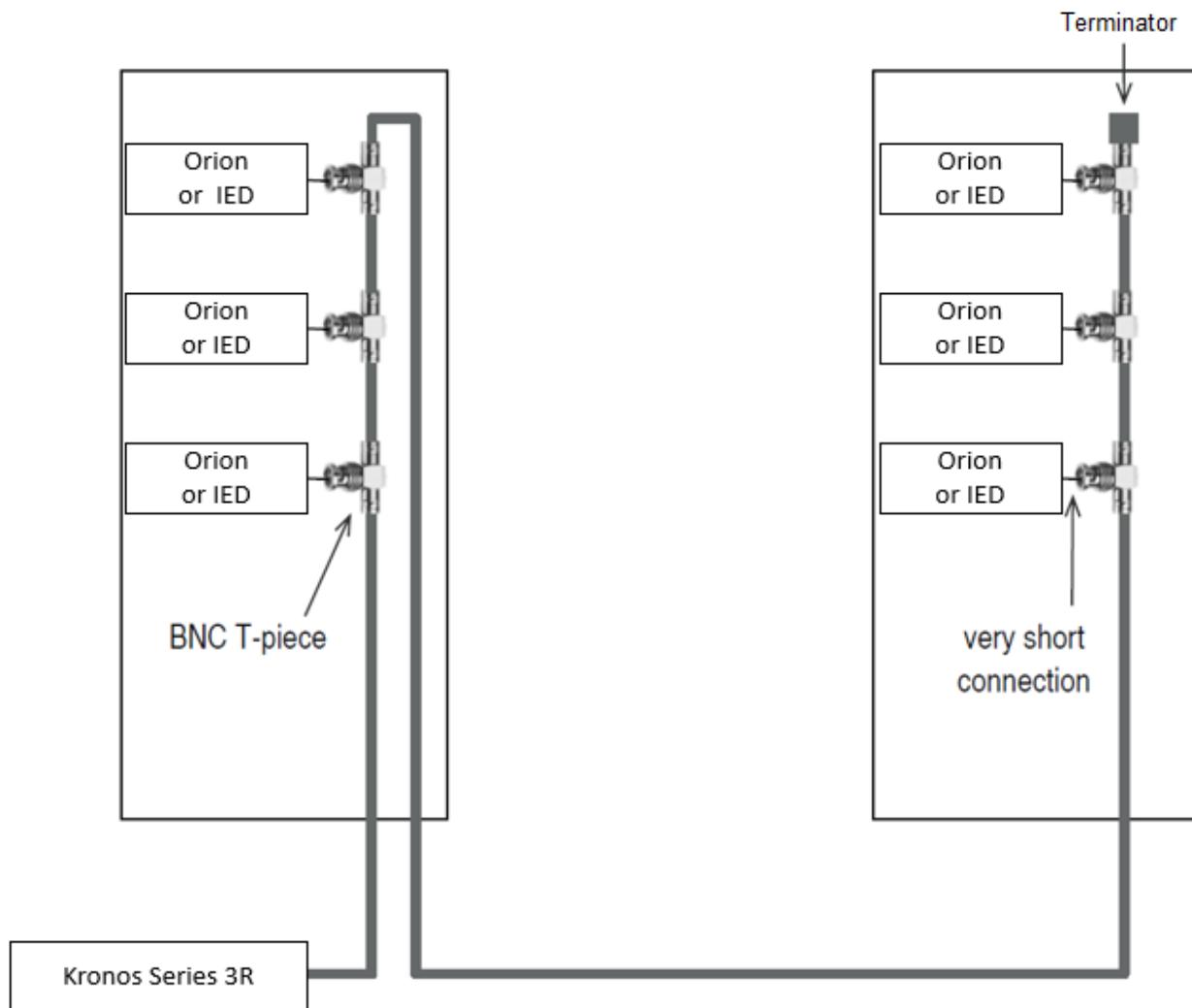


Figure 1: IRIG-B wiring to IEDs

## 2.6 Initial IP Address

At the initial power up, the IP address of the Ethernet port Eth0 of the clock is 192.168.0.1 with netmask 255.255.0.0 unless you have specified another IP address and netmask in your order.

The address of port Eth0 can be changed in one of two ways in the following two sections.

Set the IP addresses for the other ports as described in [Network Settings \(Online\)](#) or [Network Settings \(Offline\)](#).

### 2.6.1 Change in Network Settings

Point your browser to the above IP address and change the IP address and netmask of port eth0 as required. See sections [Network Settings \(Online\)](#) and [Network Settings \(Offline\)](#) for a detailed description. In these sections, you may also enable or disable the front rotary knob to set the IP address.

## 2.6.2 Change Using Front Rotary Knob

The address can also be set by pressing the front rotary knob. First, "Change IP: y/n" will be displayed. Then you can proceed to change the address by turning the rotary knob until the desired address class A (10.0...), class B (172.16...), or class C address (192.168...) is displayed. Press the knob to select that address class. Now turn the knob to set the first octet, and press to confirm octet. Then move to next octet. Repeat until all octets are set. Now the IP address is set. This requires that the knob is enabled to change the address as described in section [Port Settings](#).

The clock's webpage is available about 60 seconds after setting the new IP address.

**Note:** If a wrong IP address has been set, reset the clock to the factory default settings by pressing the reset button on the back of the clock which is labeled "WIPE\_CFG". Press the button until "Wipe cfg y/n" is shown on the display, then confirm by pressing the rotary knob.

## 2.7 Decommissioning and Disposal

There are no batteries inside of the clocks.

Nevertheless, dispose of the clock in a safe, responsible, and environmentally friendly manner, observing all applicable country-specific regulations.

Avoid incineration or disposal to water courses.

## 3 Operation

### 3.1 Front Panel Indicators

The unit's front panel comprises a dot matrix display and three LED indicators.

#### 3.1.1 Dot Matrix Display

The dot matrix display displays different information, depending on the clock state.

##### Startup

Immediately after power-up, the display shows the boot progress in percent.

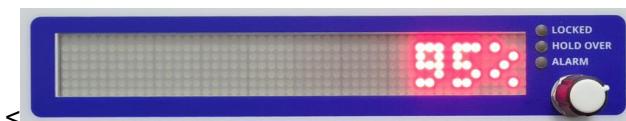


Figure 2: Clock boot – Progress display

When the boot is complete, the firmware version displays for a few seconds.



Figure 3: Clock boot – Version display

At the end of the startup sequence, the clock displays the IPv4 address assigned to port Eth0. This may be:

- The address defined in section [Initial IP Address](#), [Network Settings \(Online\)](#), or [Network Settings \(Offline\)](#).
- A self-assigned link-local address in the address block 169.254.0.0/16 (as defined in RFC 3927) if no address is defined in the configuration file.

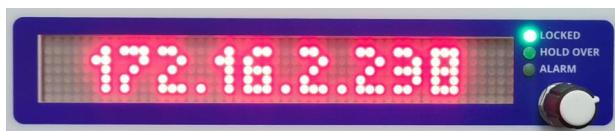


Figure 4: Clock boot – IP address display

The whole startup process takes about 45 seconds.

### First Lock

After startup, the dot matrix display displays the number of currently tracked satellites. At least four satellites are needed to obtain a first fix. Additionally almanach and ephemeris data must be downloaded from the satellites and the UTC offset must be determined.

Ephemeris data has to be downloaded from each satellite. This requires several minutes of strong signal from the tracked satellites.

The UTC offset is broadcast only once every 12 minutes, so that additionally up to 12 minutes may pass before first lock is achieved. It may take longer if the sky view is partially obstructed.

### Normal Operation

During normal operation the display will show date, time and/or time zone information. Several formats are available. See section [Display Settings \(Online\)](#) or [Display Settings \(Offline\)](#) for details.



Figure 5: Normal operation

### Alarm

If an alarm is detected, the display shows the corresponding alarm message.

#### 3.1.2 Locked Indicator

Blinking green: The clock is searching for satellites for the first satellite fix. Dot matrix display shows number of satellites currently tracked.

Solid green: Time reported by the clock is locked to atomic clocks on board the satellites. Dot matrix display shows local time, date and/or time zone, as configured.

#### 3.1.3 Holdover Indicator

Solid yellow: Time reported by the clock is derived from the internally oscillator. Error estimates are continuously compared to the user defined thresholds.

If the first error threshold is exceeded, the clock will generate a LOW QUALITY alarm but will continue to report and show time.

If the second error threshold is exceeded, the clock will generate a BAD TIME alarm and stop showing and reporting time.

## 3.2 Power Up Sequence

The power up sequence is shown in [Figure 6](#).

After power is applied to the unit, a brief short test is performed whereby the Alarm indicator lights up for less than a second. Then the firmware version is briefly shown on the dot matrix display, while the Holdover indicator is lit.

After that, the firmware will be loaded. This takes around 30 seconds. During this time a progress bar and a percentage indicator will be shown on the dot matrix display.

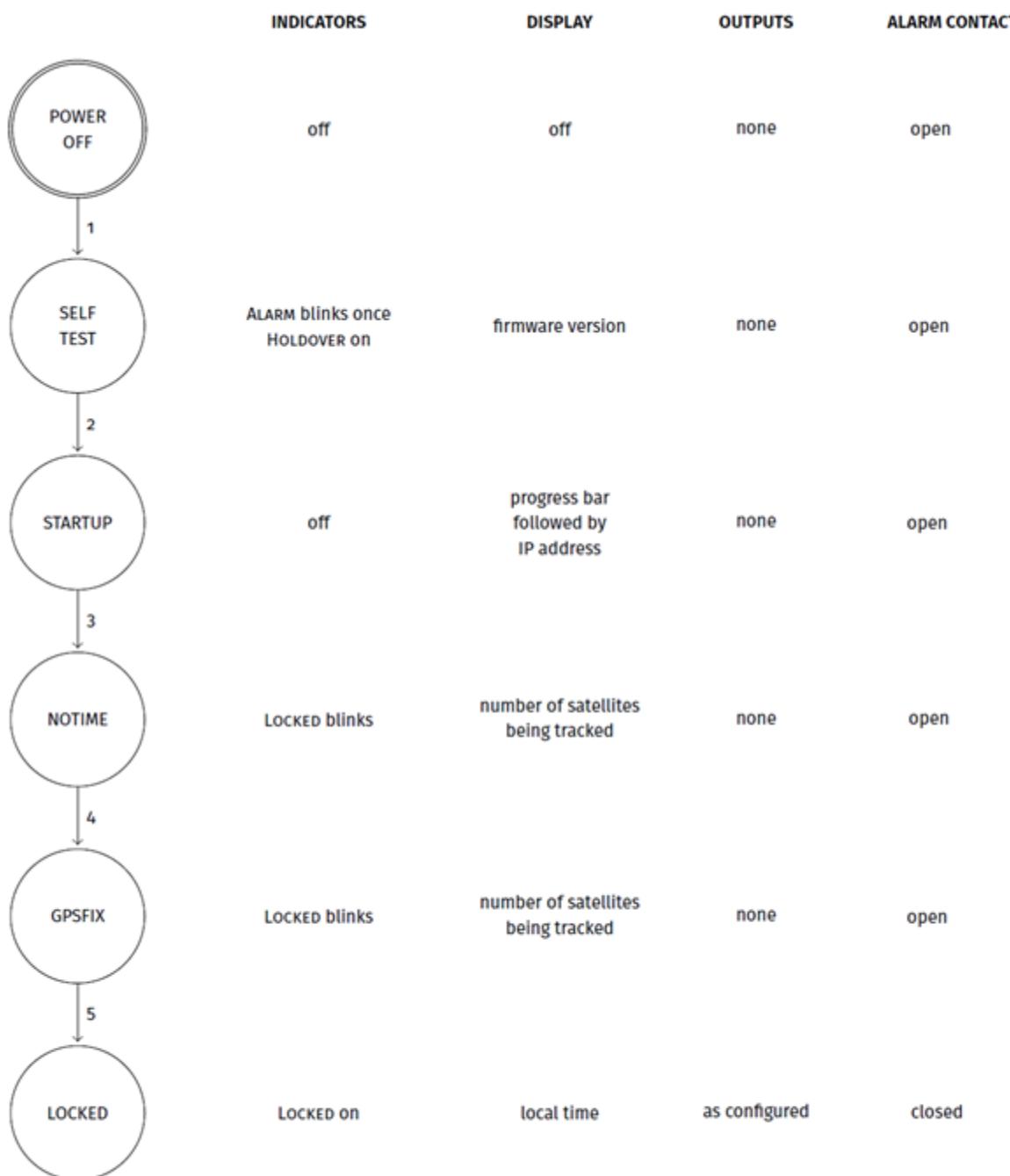
At the end of the firmware load, the IP address assigned to port eth0 will be briefly shown on the dot matrix display, but only if a network cable is plugged in.

The clock will now start tracking satellites. During this phase, the number of satellites being tracked is shown on the dot matrix display. At least four satellites are needed to obtain the initial fix. Additionally almanach and ephemeris data must be downloaded from the satellites and the UTC offset must be determined.

Ephemeris data has to be downloaded from each satellite which requires several minutes of strong signal from the tracked satellites.

The UTC offset is broadcast only once every 12 minutes, so that additionally up to 12 minutes may pass before the first lock is achieved. This takes longer if the sky view is partially obstructed.

Once all needed information is obtained and the internal oscillator is adjusted in phase and frequency, the clock will enter the Locked state. Only now will the clock start to display the local time on the dot matrix display and distribute time over the outputs, as configured.

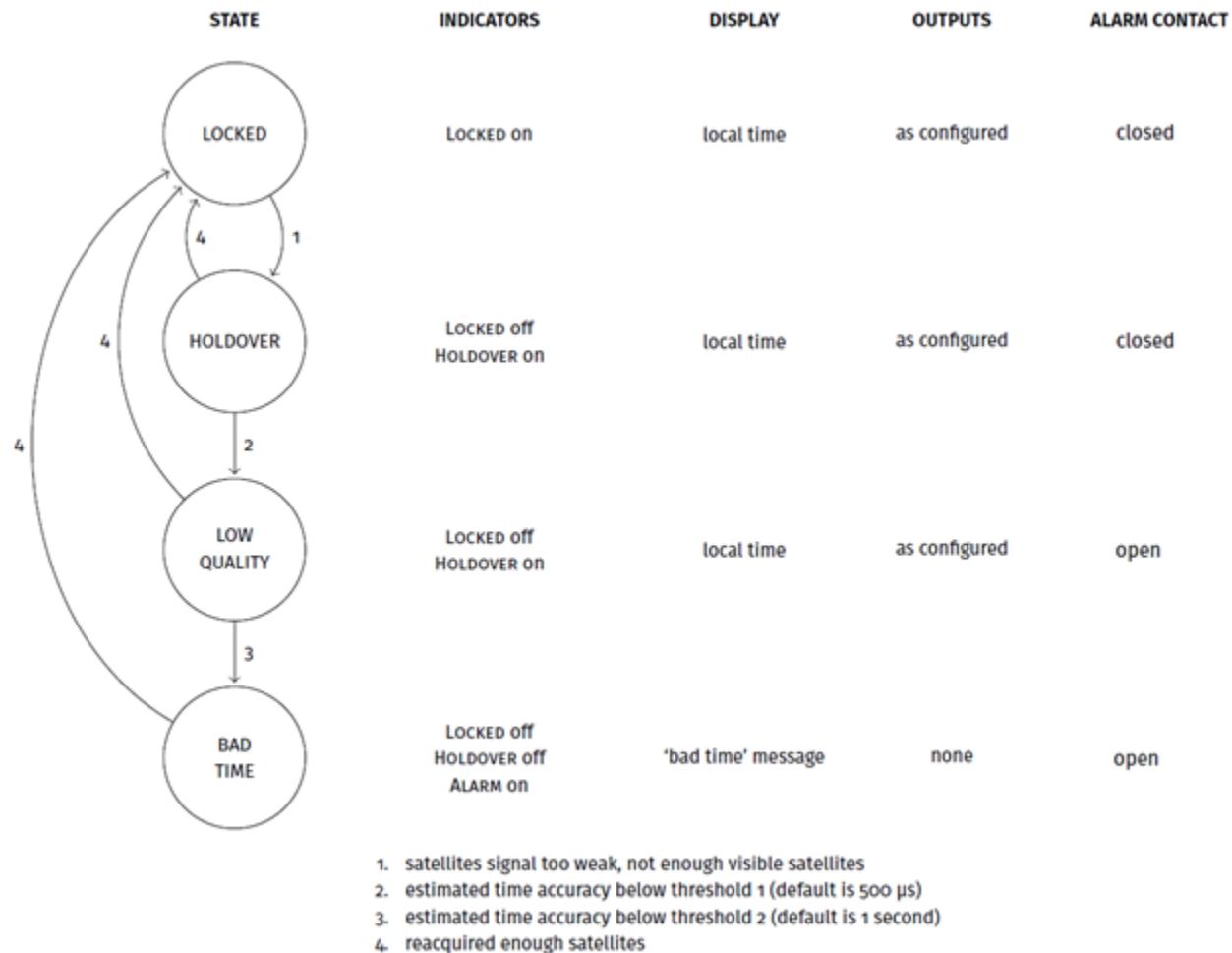


1. power applied
2. self test (2 seconds)
3. firmware load and initialization (approximately 30 seconds)
4. satellites acquired, almanach and ephemeris data downloaded
5. determined UTC offset (up to 12 minutes, longer if antenna poorly located or weak signal)

**Figure 6: Power up sequence**

### 3.3 Clock States

After first lock has been achieved (see section [Power Up Sequence](#)), the clock will be in one of four states ([Figure 7](#)):



**Figure 7: Clock states**

Clock State	Description
Locked	Enough satellites are being tracked. The internal oscillator is locked in time, frequency, and phase to the atomic clocks on board the satellites. Calibration factors for the internal oscillator are derived and kept up to date.
Holdover	Not enough satellites can be tracked to compute a solution. Time, frequency, and phase are derived from the internal oscillator. An error estimate is constantly updated and compared against two user-defined thresholds.
Low quality	Time, frequency, and phase are still derived from the internal oscillator. However, the error estimate is greater than the first user-defined threshold value. A level 1 alarm is raised to signal to the user that the first error limit has been exceeded. The default value for this threshold is 500µs. See section <a href="#">GNSS Settings (Online)</a> or <a href="#">Out-of-bound Limits (Offline)</a> for information about how to change this to a different value.

Clock State	Description
Bad time	The error estimate is greater than the second user-defined threshold value. The clock will raise a level 2 error and stop generating time signals. The dot matrix display will show a corresponding message. The default value for this threshold is 1s. See section <a href="#">GNSS Settings (Online)</a> or <a href="#">Out-of-bound Limits (Offline)</a> for information about how to change this to a different value. Normal operation, with time signal generation and display, is resumed as soon as enough satellites are re-acquired and the error estimate drops below the user-defined threshold.

Table 1: Clock states

### 3.4 Web Interface

The clock provides a web interface with a dashboard showing all relevant information ([Figure 8](#)). This is a read-only page. No sensitive information is displayed. The page can be accessed by pointing a web browser to the IP address of the clock. The only requirement is that the browser supports HTML5 and Java script.

If desired, access to this page can be password-protected as described in section [Access Passwords \(Online\)](#).

The information in the fields Identifier, Location, and Contact is set in [General Settings \(Online\)](#) or in [General Settings \(Offline\)](#).

Satellite Color	Description
Green	Satellite is used for time calculation. The size of the circle indicates the signal strength.
Yellow	Satellite is tracked but not used for time calculation.
Gray	Satellite is being acquired.

Table 2: Satellite visualization

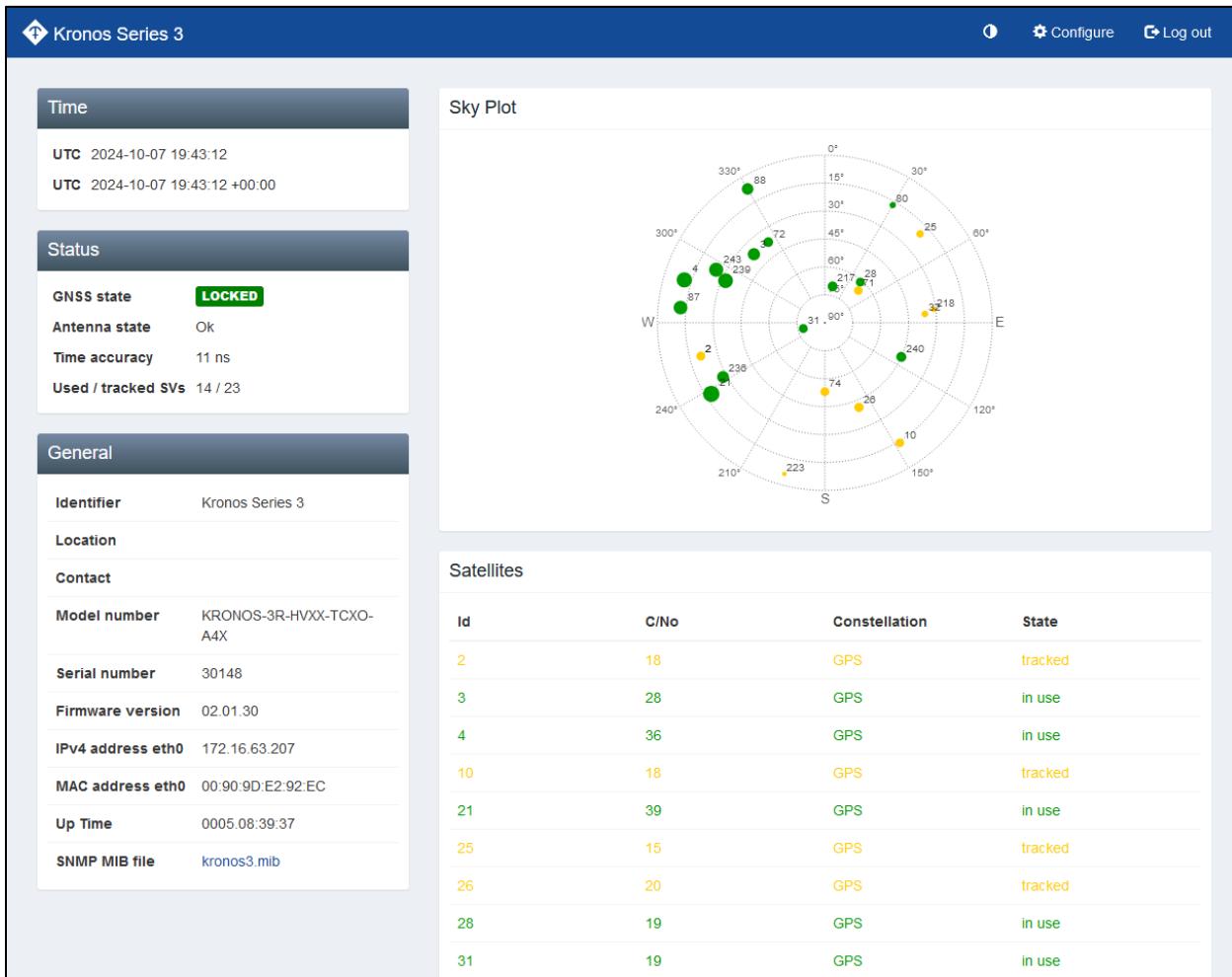


Figure 8: Clock dashboard

The webpages can be set to light or dark mode by clicking the mode button in the upper right corner.

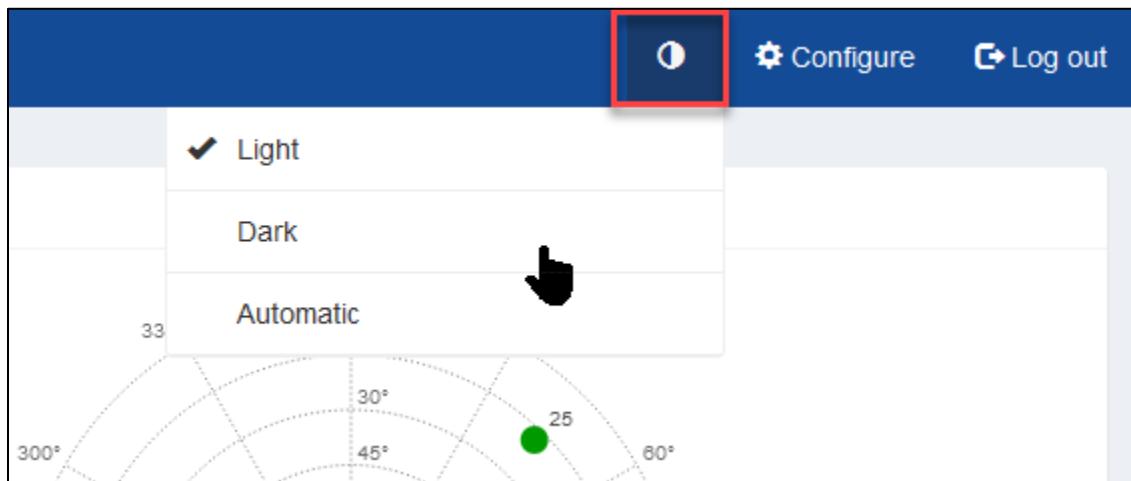


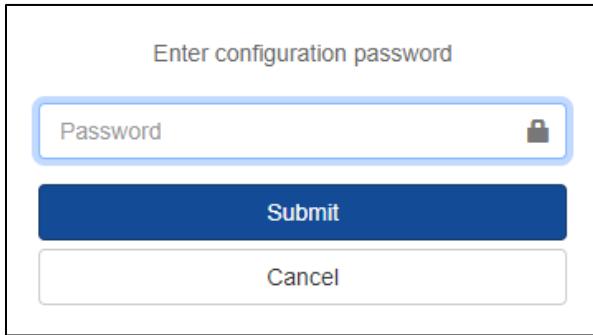
Figure 9: Set Light or Dark Mode

## 4 Online Clock Configuration with Web Interface

This section describes the online configuration of the Kronos clock using a web browser.

In the webpage shown in [Figure 8](#), click **Configure** in the upper right corner to configure the clock. The default password is `novatech` which should be changed as soon as possible. The configuration pages have a non-activity timeout of 20 minutes.

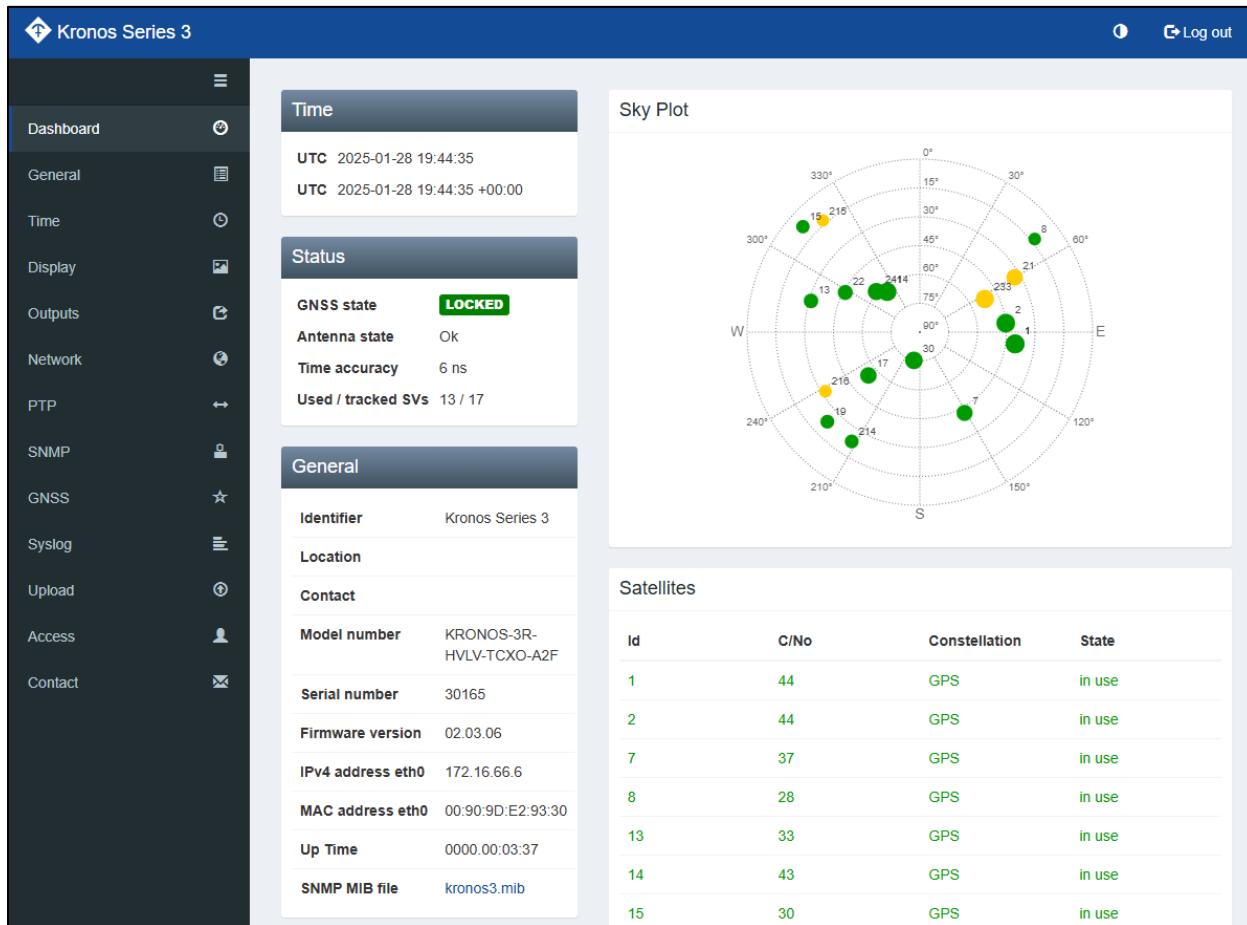
First, point the browser to the IP address of the clock as shipped or set in section [Initial IP Address](#).



The image shows a rectangular dialog box titled "Enter configuration password". Inside, there is a text input field labeled "Password" with a lock icon to its right. Below the input field is a blue "Submit" button. At the bottom of the dialog is a "Cancel" button.

Figure 10: Enter configuration password

Then the clock parameters can be configured via the navigation pane on the left side in the following figure.



**Figure 11: Clock configuration page**

Note that the Access Passwords can only be configured in the webpage in [Access Passwords \(Online\)](#) but not offline.

## 4.1 General Settings (Online)

The general settings are configured on the following webpage tab. The same settings can be made offline as described in [General Settings \(Offline\)](#). These strings are reported as sysName, sysLocation, and sysContact over SNMP. They are also included in all log files.



**Figure 12: General settings**

Item	Description
Identifier	The identifier is shown on the dashboard web page and reported as sysName when using SNMP.
Location	The location is shown on the dashboard web page and reported as sysLocation when using SNMP.
Contact	The contact is shown on the dashboard web page and reported as sysContact when using SNMP.

**Table 3: General settings**

## 4.2 Time Zone Settings (Online)

The time zone and daylight savings time settings are configured on the following webpage tab. The same settings can be made offline as described in [Time Zone Settings \(Offline\)](#).

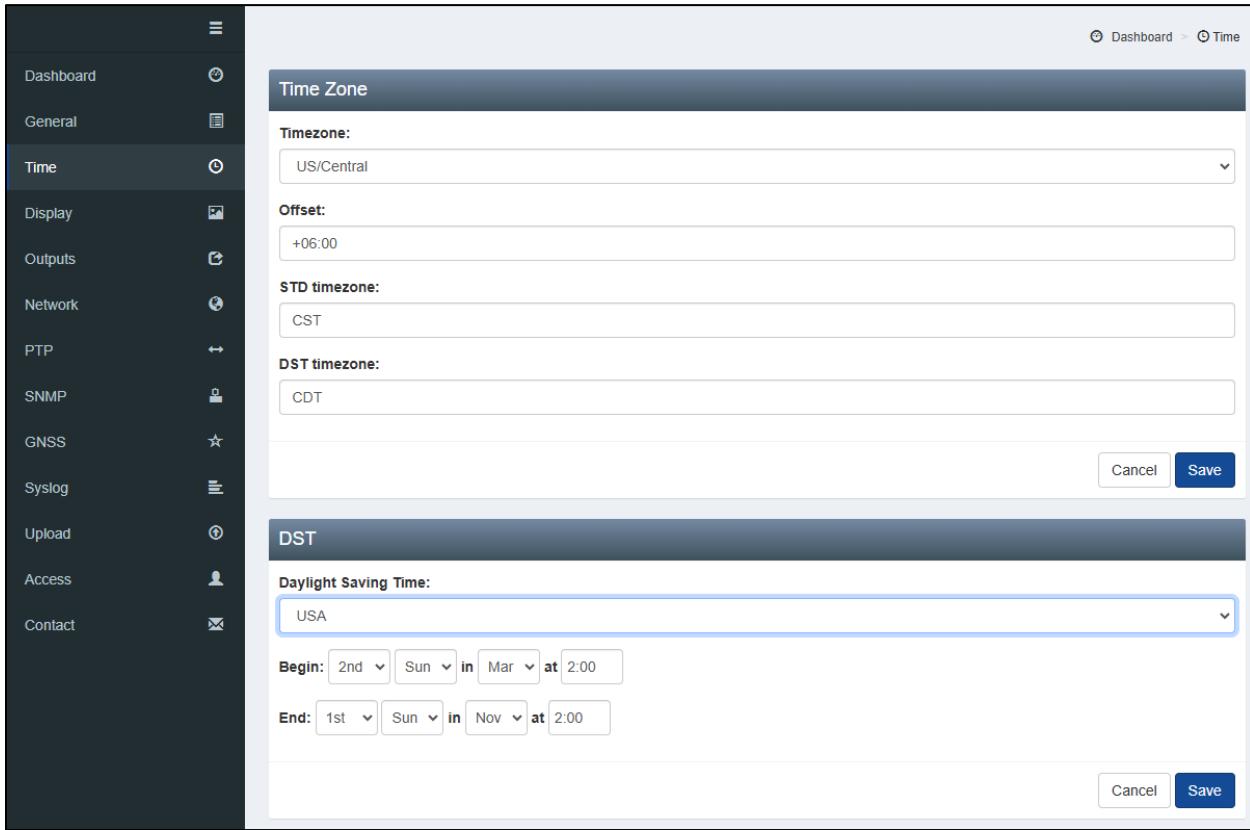


Figure 13: Time settings

Item	Description
Timezone	Select UTC or the time zone in which the clock is installed. Then the fields Offset, STD timezone, and DST timezone display the UTC offset, the standard time zone name, and the daylight saving time zone name.
Daylight Saving Time	Select the desired daylight saving time. The available selections are Custom, Off, Eastern Europe, Central Europe, Western Europe, USA, and Brazil. If your selection is not listed, select Custom and set the daylight saving begin and end in Begin and End.
Begin	Specify the desired weekday, month, and time when the daylight saving time begins. If a defined value such as USA is selected in Daylight Saving Time, the values in Begin are preset but can still be customized.
End	Specify the desired weekday, month, and time when the daylight saving time ends. If a defined value such as USA is selected in Daylight Saving Time, the values in End are preset but can still be customized.

Table 4: Time settings

## 4.3 Display Settings (Online)

The display settings determine how the time is shown on the display at the front of the clock. The same settings can be made offline as described in [Display Settings \(Offline\)](#).



Figure 14: Display settings

Item	Description
day-of-year (001 to 366) + HH:MM:SS	Displays day of year and current time. 
HH:MM:SS + TIMEZONE	Displays current time and time zone. 
HH:MM:SS + TIMEZONE OFFSET	Displays current time and time zone offset. 
dd mmm HH:MM:SS	Displays day, month, and current time. This is the default setting. 
HH:MM:SS + number of satellites	Displays current time and number of used satellites. 

Table 5: Display settings

## 4.4 Output Settings (Online)

The output settings are configured on the following webpage tab. The same settings can be made offline as described in [Output Settings \(Offline\)](#).

**Note:** The polarity (normal, inverse) can only be configured offline as described in [Output Settings \(Offline\)](#).

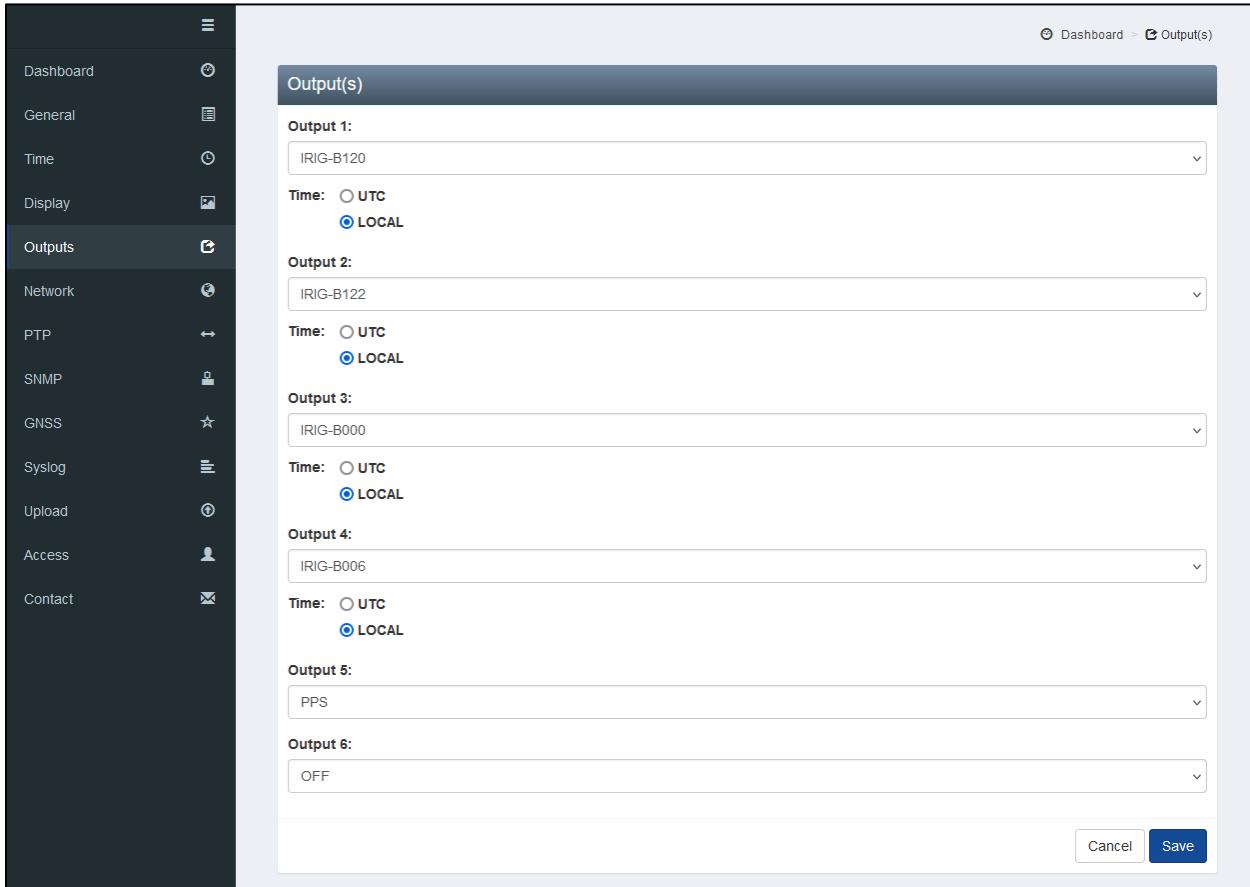


Figure 15: Outputs settings

The single unmodulated output card (-1) has one output. The dual unmodulated output card (-2), the dual modulated output card (-A), and the fiber output card (-F) have two outputs each. The quad unmodulated output card card (-4) has four outputs. For each output, the output type and the time setting can be configured as shown in the following table.

The example in [Figure 15](#) shows a configuration with a -A card in slot 1 and a -4 card in slot 2. On the -4 card, the outputs are configured in pairs labelled a./b. In this example, output 3 configures the two outputs labelled 3a./3b, and output 4 configures the two outputs 4a./4b. On the outputs cards with one or two outputs, the outputs are configured individually.

See [Appendix A – Options List](#) for information about how to interpret the part number and determine the number and type of outputs available in your unit.

Item	Description		
	Card Name	Card Type	Signals
Output type	-1 -2 -4 -F	Single unmodulated output Dual unmodulated outputs Quad unmodulated outputs Dual fiber outputs	OFF PPM PPS IRIG-B000 IRIG-B002 IRIG-B004 IRIG-B006
	-A	Dual modulated outputs	OFF IRIG-B120 IRIG-B122 IRIG-B124 IRIG-B126
	Default: OFF		
Time UTC Local	The output can be set to send either UTC time or local time.		

Table 6: Outputs settings

## 4.5 Network Settings (Online)

This section describes the configuration of network parameters for clock's Ethernet ports. The clock has one RJ45 Ethernet port (eth0) for configuration and monitoring, and four SFP slots (eth1-eth4).

The same settings can be made offline as described in [Network Settings \(Offline\)](#).

### 4.5.1 Gateway Setting

Set the IP address of the gateway on the following tab.

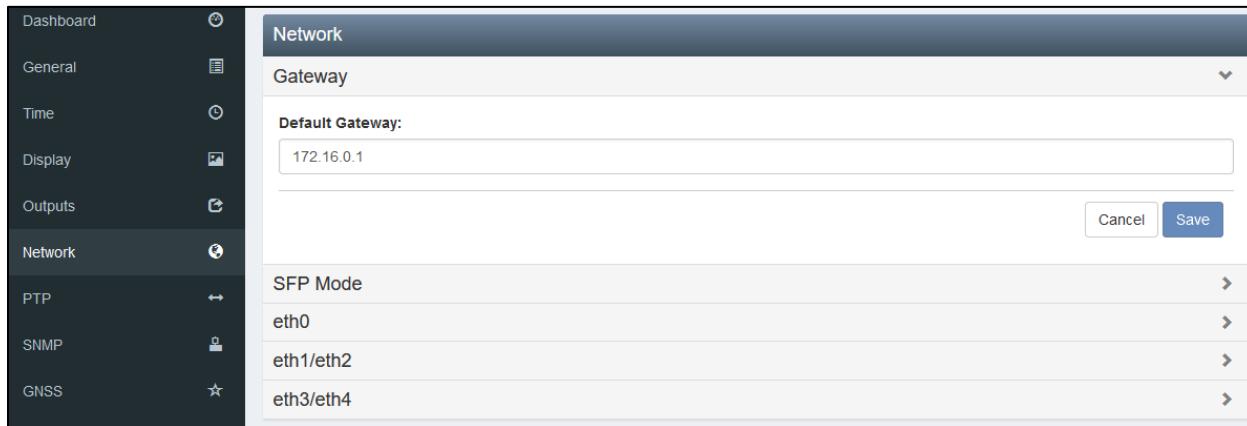


Figure 16: Gateway setting

#### 4.5.2 Set SFP Mode (Online)

Configure the standalone or HSR/PRP mode of the four SFP ports as follows. The same settings can be made offline as described in [Set SFP Mode \(Offline\)](#).

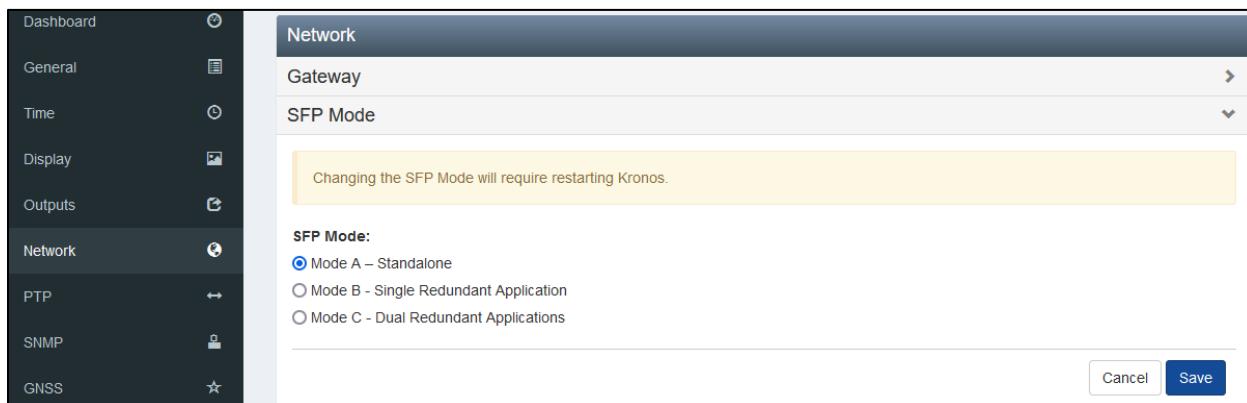


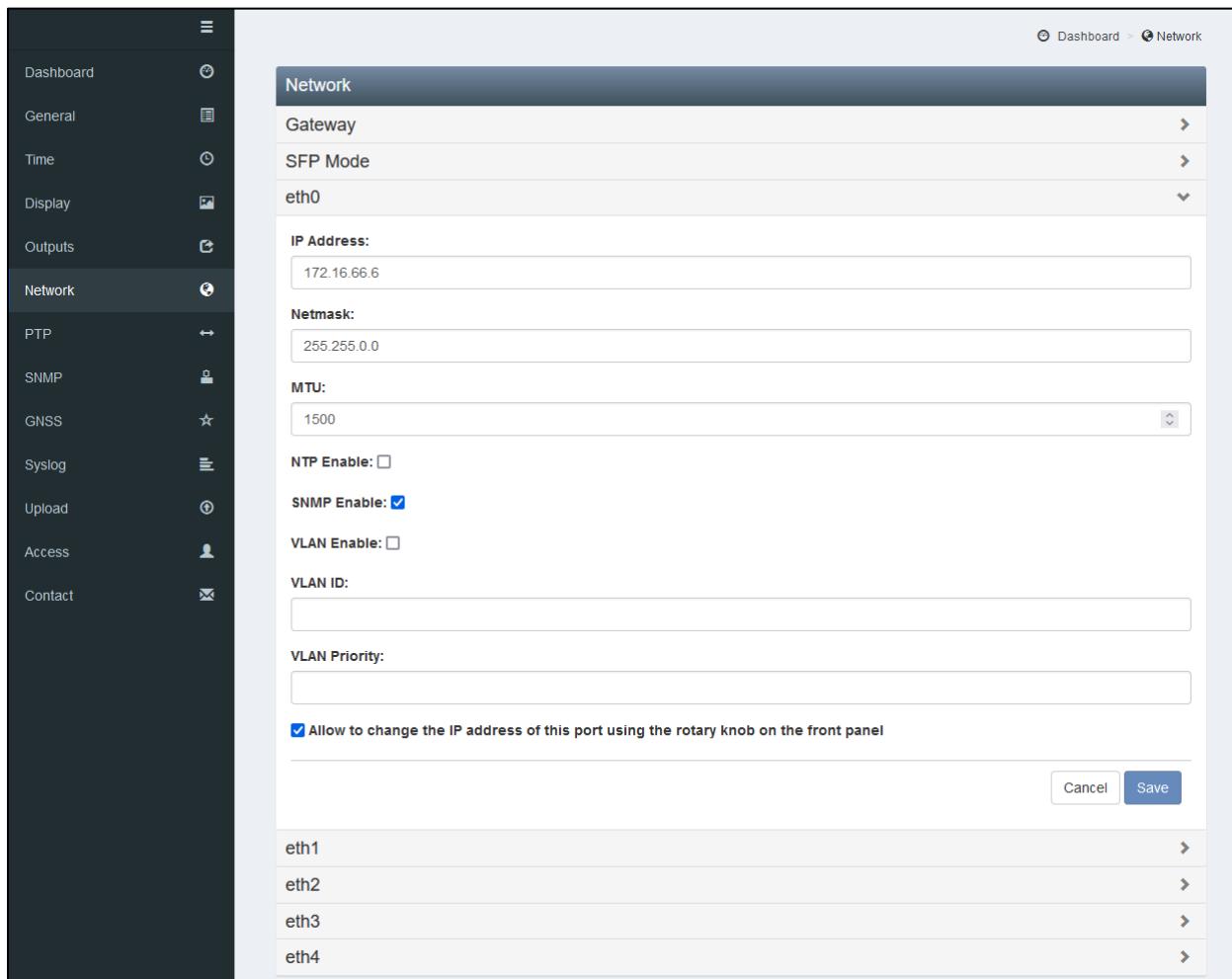
Figure 17: Set SFP Mode

SFP Mode	Description
Mode A	Ports eth1, eth2, eth3, and eth4 operate as four standalone ports, each with its own IP address, MTU, NTP, PTP, SNMP, and VLAN settings.
Mode B	Ports eth1 and eth2 operate as one HSR/PRP port, and ports eth3 and eth4 operate as two standalone ports.
Mode C	Ports eth1 and eth2 operate as one HSR/PRP port, and ports eth3 and eth4 operate as one HSR/PRP port.

Table 7: Set SFP Mode

#### 4.5.3 Port Settings

Configure the settings for each port as follows. The same settings can be made offline as described in [Network Settings \(Offline\)](#). Note that the available setting for Eth0 vs. SFP ports (Eth1-Eth4) differ slightly as described below.



The screenshot shows the 'Network' configuration page. On the left is a sidebar with links: Dashboard, General, Time, Display, Outputs, Network (selected), PTP, SNMP, GNSS, Syslog, Upload, Access, and Contact. The main area has a header 'Network' with sub-links: Gateway, SFP Mode, and a dropdown for 'eth0'. Below this are fields for IP Address (172.16.66.6), Netmask (255.255.0.0), MTU (1500), NTP Enable (unchecked), SNMP Enable (checked), VLAN Enable (unchecked), VLAN ID (empty), VLAN Priority (empty), and a checkbox for 'Allow to change the IP address of this port using the rotary knob on the front panel' (checked). At the bottom are 'Cancel' and 'Save' buttons. Below the main section are sections for 'eth1', 'eth2', 'eth3', and 'eth4' with expand arrows.

**Figure 18: Port settings**

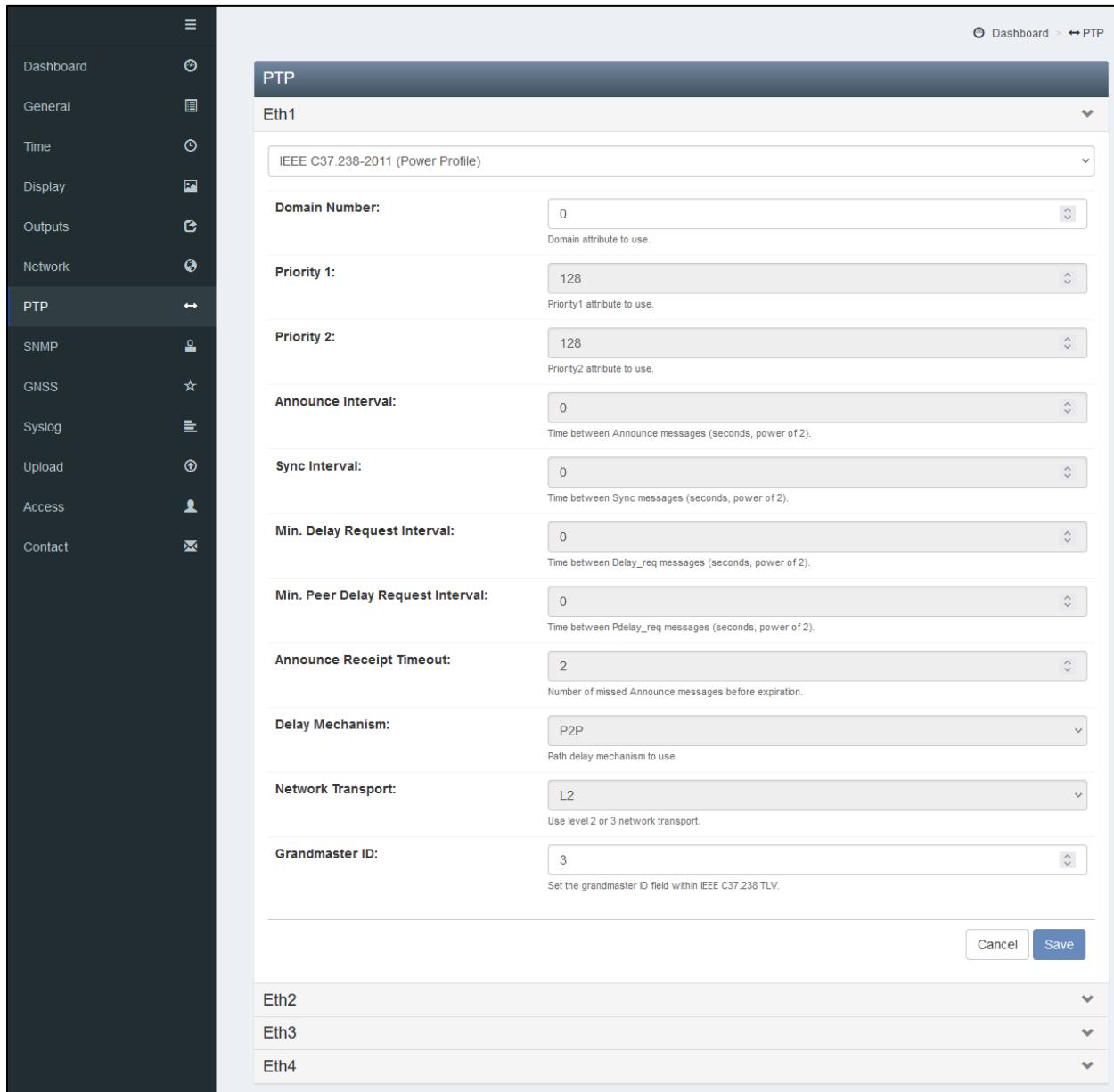
Item	Description
IP address	Set the IP address of the port.
Netmask	Set the netmask of the port.
MTU	Maximum Transmission Unit sets the largest size in bytes of a packet that can be transmitted over the port in a single transaction.
Redundancy Mode (if eth1/eth2 or eth3/eth4 are set to HSR/PRP in <a href="#">Figure 17</a> )	Set the redundancy for eth1/eth2 or eth3/eth4.. HSR      HSR redundancy PRP      PRP redundancy

Item	Description
NTP Enable	Check this box to enable NTP on the port. When enabled, Network Time Security (NTS) is also enabled. NTS is a cryptographic protocol to secure NTP against packet spoofing, replay attacks, and man-in-the-middle attacks. NTS requires a key. By default, the key kronos3.pem is used. It is recommended to use your own .pem file. See section <a href="#">Keys (Offline)</a> for details.
PTP Enable (only for Eth1, Eth2, Eth3, Eth4)	Check this box to enable PTP on the port. Select the PTP profile in section <a href="#">PTP Settings (Online)</a> .
SNMP Enable	Check this box to generate SNMP messages for this port.
VLAN Enable	Check this box to enable VLAN on this port.
VLAN ID	Set the VLAN ID.
VLAN Priority	Set the VLAN priority
Allow to change the IP address of this port using the rotary knob on the front panel (only for Eth0)	Check this box to enable setting the IP address of Eth0 using the dial on the front panel. See section <a href="#">Change Using Front Rotary Knob</a> for details.

Table 8: Ethernet port settings

## 4.6 PTP Settings (Online)

Configure the PTP settings for Eth1, Eth2, Eth3, and Eth4 as well as configured HSR/PRP ports as follows. The same settings can be made offline as described in [PTP Settings \(Offline\)](#). However, it is recommended to make the settings on the webpage since selecting the desired profile automatically sets all related parameters.



**PTP**

Eth1

IEEE C37.238-2011 (Power Profile)

**Domain Number:** 0  
Domain attribute to use.

**Priority 1:** 128  
Priority1 attribute to use.

**Priority 2:** 128  
Priority2 attribute to use.

**Announce Interval:** 0  
Time between Announce messages (seconds, power of 2).

**Sync Interval:** 0  
Time between Sync messages (seconds, power of 2).

**Min. Delay Request Interval:** 0  
Time between Delay\_req messages (seconds, power of 2).

**Min. Peer Delay Request Interval:** 0  
Time between Pdelay\_req messages (seconds, power of 2).

**Announce Receipt Timeout:** 2  
Number of missed Announce messages before expiration.

**Delay Mechanism:** P2P  
Path delay mechanism to use.

**Network Transport:** L2  
Use level 2 or 3 network transport.

**Grandmaster ID:** 3  
Set the grandmaster ID field within IEEE C37.238 TLV.

**Eth2**

**Eth3**

**Eth4**

**Cancel** **Save**

**Figure 19: PTP settings**

For convenience, it is recommended to select the profile on this webpage instead of setting the values manually in the configuration file using an ASCII editor.

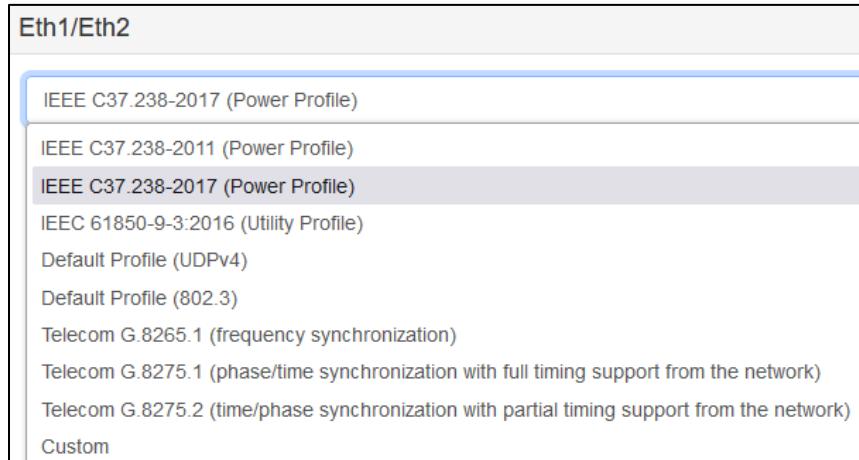


Figure 20: Supported PTP Profiles

**Note:** If multiple interfaces are set up with a Power profile, then the Grandmaster ID for each interface must be set to a different value. If interfaces using a Power profile are set to the same Grandmaster ID, then PTP will work on only one of those interfaces.

Item	Description
Enable	Check the box to enable PTP on this port.
Profile	Selecting one of the following profiles sets all options below to default values. In <a href="#">Figure 19</a> , values in white can then be further changed. Values in gray are specified by the profile and cannot be changed. If a profile is selected all parameters are preset. Custom allows setting any parameter without restriction by a profile.

Item	Description
Grandmaster ID Domain Number Priority 1 Priority 2 Announce Interval Sync Interval Min. Delay Request Interval Min. Peer Delay Request Interval Announce Receipt Timeout Delay Mechanism Hybrid E2E Network Transport UDP TTL Inhibit Multicast Service Unicast Listen Unicast Required Duration Dataset Comparison G.8275 Default DS Local Priority G.8275 Port DS Local Priority Power Profile TLV Enabled Transport Specific PTP DST MAC P2P DST MAC	Each profile sets default values for the parameters it supports. If the parameter is displayed with white background, the value can be changed. If the parameter is displayed with gray background, the value cannot be changed. See <a href="#">Figure 19</a> for a complete listing of supported values of each profile.

Table 9: PTP settings

## 4.7 SNMP Settings (Online)

Configure the SNMP settings as follows. The same settings can be made offline as described in [SNMP Settings \(Offline\)](#).



The screenshot shows a configuration dialog for SNMPv1 settings. The title bar says "SNMPv1". The main area has a label "RO Community:" followed by a text input field containing the value "PUBLIC". At the bottom right are two buttons: "Cancel" and "Save".

Figure 21: SNMPv1 settings

Item	Description
RO Community	The supported values are PUBLIC and PRIVATE.

Table 10: SNMPv1 settings

### SNMPv2

**RO Community:**  
PRIVATE

**Trap Community:**  
PRIVATE

**Trap Host1:**  
172.16.188.116

**Trap Host2:**  
172.16.123.90

Figure 22: SNMPv2 settings

Item	Description
RO Community	The supported values are PUBLIC and PRIVATE.
Trap Community	Name of trap community
Trap Host 1	IP address of trap host 1.
Trap Host 2	IP address of trap host 2.

Table 11: SNMPv2 settings

### SNMPv3

**Auth Name:**  
whatever.you.want

**Auth Key:**  
very.secret.password

**Auth Protocol:**  
SHA

Figure 23: SNMPv3 settings

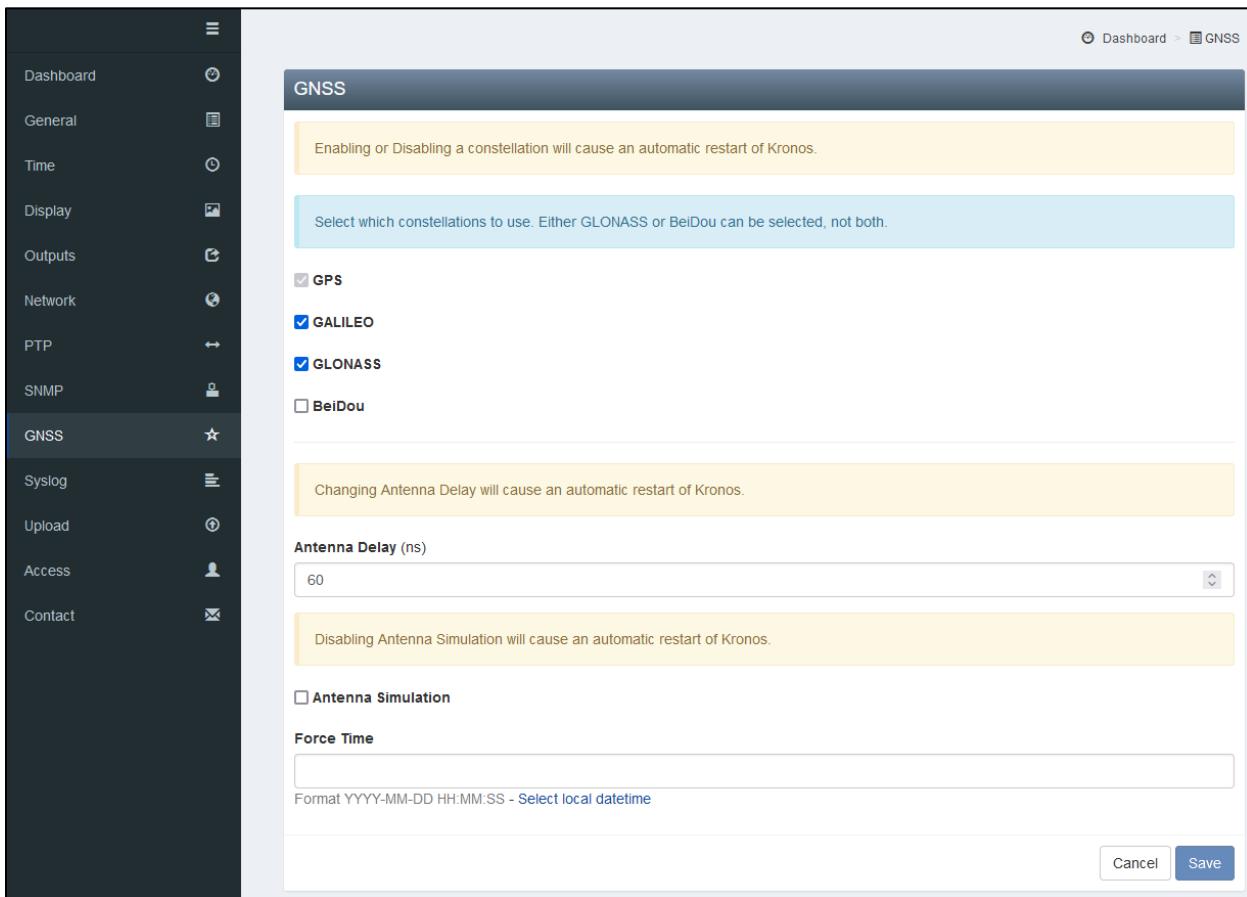
Item	Description
Auth Name	Enter authentication name.
Auth Key	Enter authentication key.
Auth Protocol	Select SHA or MD5.

Table 12: SNMPv3 settings

## 4.8 GNSS Settings (Online)

Configure the GNSS constellations and out-of-bound limits as follows. The same settings can be made offline as described in [GNSS Settings \(Offline\)](#) and [Out-of-bound Limits \(Offline\)](#).

**Note:** Switching between GNSS may affect the long term accuracy of the receiver until the next cold start. In normal operation, the receiver selects the best models and corrections from the transmitted auxiliary data (e.g. UTC and ionospheric parameters), basing this selection on the configured GNSS. Disabling a major GNSS prevents auxiliary data from that GNSS being refreshed and so it will become stale, resulting in progressively degraded performance. For this reason, NovaTech recommends that the satellite clock be cold started after any change that disables an active GNSS, within a few weeks, but preferably immediately. This will ensure that the GNSS receiver then uses only regularly refreshed information from the newly configured constellations



The screenshot shows the Kronos Series 3 web interface. The left sidebar is dark with white text and icons, listing various configuration categories: Dashboard, General, Time, Display, Outputs, Network, PTP, SNMP, GNSS (selected), Syslog, Upload, Access, and Contact. The main panel is titled 'GNSS'. It contains a note: 'Enabling or Disabling a constellation will cause an automatic restart of Kronos.' Below this is a section to 'Select which constellations to use. Either GLONASS or BeiDou can be selected, not both.' with checkboxes for GPS (checked), GALILEO (checked), GLONASS (checked), and BeiDou (unchecked). Another note: 'Changing Antenna Delay will cause an automatic restart of Kronos.' Below this is a 'Antenna Delay (ns)' input field containing '60' with a dropdown arrow. A note: 'Disabling Antenna Simulation will cause an automatic restart of Kronos.' Below this is a 'Antenna Simulation' checkbox (unchecked). At the bottom is a 'Force Time' input field with placeholder text 'Format YYYY-MM-DD HH:MM:SS - Select local datetime' and a 'Save' button.

Figure 24: GNSS and out-of-bound limits settings

Item	Description									
GPS	GPS is always enabled and cannot be disabled.									
GALILEO	With option TCXO, Galileo can be enabled or disabled as desired. With option OCXO, Galileo is not supported.									
GLONASS BeiDou	Either Glonass or BeiDou can be enabled, but not both at the same time.									
Antenna Delay	Enter the delay introduced by the antenna cable in nanoseconds to compensate for the delay. The delay is as follows:									
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Cable Type</th> <th>Per foot</th> <th>Per meter</th> </tr> </thead> <tbody> <tr> <td>RG58</td> <td>~1.5ns</td> <td>~4.9ns</td> </tr> <tr> <td>LMR400</td> <td>~1.2ns</td> <td>~3.9ns</td> </tr> </tbody> </table>	Cable Type	Per foot	Per meter	RG58	~1.5ns	~4.9ns	LMR400	~1.2ns	~3.9ns
Cable Type	Per foot	Per meter								
RG58	~1.5ns	~4.9ns								
LMR400	~1.2ns	~3.9ns								
Antenna Simulation Force Time	To run the clock without a connected antenna, or for specific testing purposes, check Antenna Simulation and enter the start time in Force Time which the clock will use for this simulation. Click Select local datetime to set the clock to the time of the PC.									

Table 13: GNSS settings

Out-of-Bounds Limits

Low Quality and Bad Time values are in milliseconds. Low Quality valid values are from 0.001 (1 microsecond) to 4000 (4 seconds).

**Low Quality (ms)**

**Bad Time (ms)**

Cancel
Save

Figure 25: Out-of-Bounds Limits

Item	Description
Low Quality	When the time becomes inaccurate by more than the time specified value, the LOWQUALITY alarm is set. The range is 0.001 to 4000ms. Default: 0.5ms
Bad Time	When the time becomes inaccurate by more than the time specified value, the BADTIME alarm is set. The range is 0.001 to 4000ms. Default: 1000ms

Table 14: Out-of-bounds limits settings

See section [Clock States](#) for an explanation of how the limits in [Table 14](#) affect clock operation.

## 4.9 Syslog (Online)

Configure the syslog as follows. The same settings can be made offline as described in [Syslog \(Offline\)](#). To disable syslog, leave the fields Target\_A and Target\_B empty.

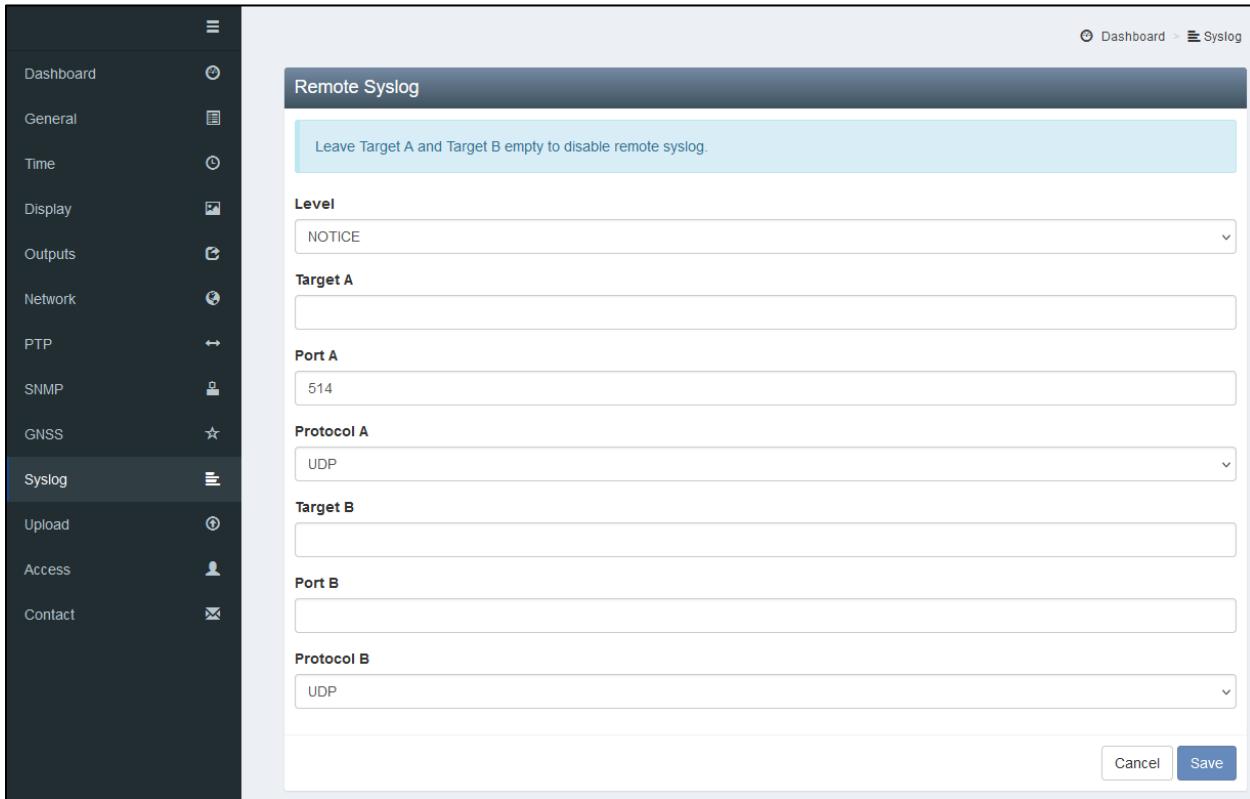


Figure 26: Syslog settings

Parameter	Description
[SYSLOG]	Section name for syslog settings.
LEVEL	Select the desired priority (see <a href="#">Table 16</a> ) for sending syslog messages. The set priority includes all higher priorities. The highest priority that can be set in Series 3R is Error which automatically includes Critical, Alarm, and Emergency.
TARGET_A	IP address of the primary syslog server.
PORT_A	Port used by the primary syslog server.
PROTOCOL_A	Protocol used by the primary syslog server. Select TCP or UDP.
TARGET_B	IP address of the secondary syslog server.
PORT_B	Port used by the secondary syslog server.
PROTOCOL_B	Protocol used by the secondary syslog server. Select TCP or UDP.

Table 15: Syslog settings

Level	Text	Series 3R Operational Events
0	Emergency	None
1	Alert	None
2	Critical	None
3	Error	None
4	Warning	<ul style="list-style-type: none"> <li>▪ Antenna open</li> <li>▪ Antenna short</li> <li>▪ Bad time limit exceeded</li> <li>▪ Power supply status goes from Good to Bad</li> </ul>
5	Notice	<ul style="list-style-type: none"> <li>▪ Configuration changes</li> <li>▪ GNSS receiver state changes (locked, holdover)</li> </ul>
6	Informational	<ul style="list-style-type: none"> <li>▪ SSH access</li> <li>▪ SFTP access</li> </ul>
7	Debug	None

Table 16: Syslog priority levels

## 4.10 Upload (Online)

Upload the following files to the clock by clicking Select file to upload or drag & drop the respective file to this page.

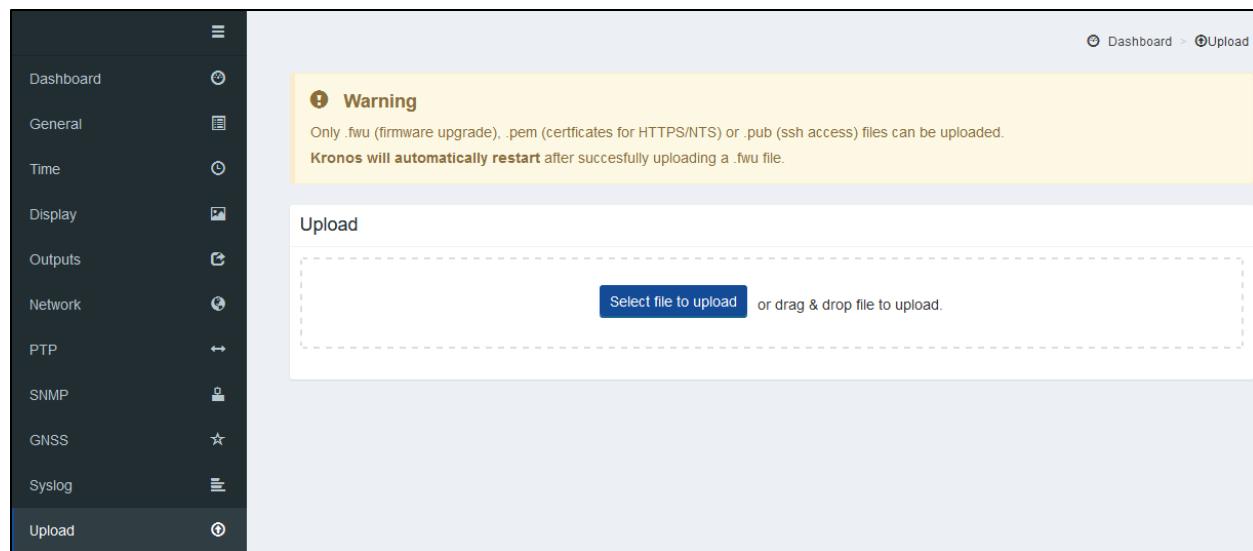


Figure 27: Update files

File Type	Purpose	Alternative Upload
.fwu	Firmware file	See section <a href="#">Appendix D – Firmware Update Procedure</a>
.pem	Certificate for HTTPS and NTS	See section <a href="#">Keys (Offline)</a>
.pub	SSH access	See section <a href="#">Keys (Offline)</a>

Table 17: Upload Files

**Note:** After the uploading a new .fwu firmware to the clock, the clock will restart automatically and run the updated firmware.

This page does not support file types other than those listed above.

The latest .fwu file is available on the NovaTech Support Site at [https://support.novatechautomation.com/kronos/?model=series\\_3r](https://support.novatechautomation.com/kronos/?model=series_3r). If you need login credentials, contact [support@novatechautomation.com](mailto:support@novatechautomation.com).

## 4.11 Access Passwords (Online)

The access passwords are configured on the following webpage tab.



The screenshot shows the NovaTech web interface with a dark-themed sidebar. The sidebar includes links for Dashboard, General, Time, Display, Outputs, Network, PTP, SNMP, GNSS, Syslog, Upload, and Access. The Access link is highlighted. The main content area is titled 'Passwords' and contains the following configuration fields:

- Configuration:** novatech
- Firmware/Keys Upload:** novatech
- Status monitoring:** novatech
- Enforce HTTPS:** Always

At the bottom right of the form are 'Cancel' and 'Save' buttons.

Figure 28: Access settings

Item	Description
Configuration	Enter a secure password for accessing the clock configuration with web page ( <a href="#">Figure 10</a> ) and SFTP client ( <a href="#">SFTP Access</a> ). If left blank, no password is required for accessing the clock configuration. Default password: novatech
Firmware Update	Enter a secure password for updating the firmware ( <a href="#">Appendix D – Firmware Update Procedure</a> ). If left blank, no password is required for updating the firmware. Default password: novatech
Status Monitoring	Enter a secure password for accessing the main page ( <a href="#">Figure 8</a> ). If left blank, no password is required for accessing the main page. The default password is empty.
Enforce HTTPS	NEVER      HTTPS is never enforced CFG_ONLY    HTTPS enforced only for configuration page (default) ALWAYS     Enforce HTTPS always.

**Table 18: Access settings**

## 5 Offline Clock Configuration with Configuration File

This section describes the offline configuration of the clock by editing the configuration file on a PC. This requires using an SFTP client on the PC to download the configuration file from the clock and then upload the edited configuration file to the clock again. The SFTP access is described in section [SFTP Access](#).

### 5.1 Configuration File Structure

The configuration file is a single text file (ASCII file) which is segmented into sections. In each section there are one or more variables. Values are assigned to variables using the equal sign ('=').

The structure is very similar to the INI files used in Microsoft Windows. See [Appendix E – Sample Configuration File](#) for a complete sample configuration file.

The configuration file is named kronos3.cfg. It can be downloaded/uploaded using the SFTP protocol (user cfg, see section [SFTP Access](#)). Some SFTP clients also allow online editing of the configuration file. If editing offline, use only ASCII text editors (like Windows Notepad).

**Note:** **Do NOT use a word processor (like Microsoft Word or WordPad) to edit the configuration file. Word processors insert hidden formatting characters that are not correctly interpreted by the clock.**

Sections and variables are case insensitive. Any combination of uppercase and lowercase letters can be used. Most values are also case insensitive, except for passwords which are case sensitive. Spaces (ASCII 32) and tabs (ASCII 08) can be freely used to improve the legibility of the configuration file.

#### 5.1.1 Sections

The configuration file is segmented into Sections. A section name is enclosed in square brackets and must be the only text on a line. Section names are case insensitive. Example:

```
[SectionName]
```

**Note:** **Section names should be kept on a line of their own. Comments (see below) are NOT allowed on lines with section names.**

#### 5.1.2 Variables and Values

In any section there are one or more variables, declared with the following syntax:

```
Variable = value
```

Variable names are case insensitive. The value is any character on the right side of the equal sign. Quotes can be used to enclose the values, but they are not required. If no quotes are present, the value is understood as containing all characters between the first and the last non-blank characters before the comment. If quotes are present, the value is understood as containing all characters between the quotes, with the quotes themselves not being considered to be part of the value.

The following declarations are identical:

```
Hello = "this is a long string value"
Hello = this is a long string value
```

### 5.1.3 Comments

Lines starting with a hash sign (#) are considered to contain comments and discarded by the clock:

```
# This is a comment, notice the hash sign
```

Comments can also be given on value lines using a semicolon. Everything after the semicolon up to the end of the line is ignored by the clock:

```
SomeVariable = some_value ; this is also a comment
```

### 5.1.4 Blank Lines

Blank lines (i.e. lines containing only blanks or tabs) can be used to visually separate the sections of the configuration file and increase readability.

## 5.2 Set SFP Mode (Offline)

This section configures the standalone or HSR/PRP mode of the four SFP ports. The same settings can be made in the webpage as described in [Set SFP Mode](#).

```
# SFP configuration
# MODE A: 4 independent network ports (eth1 ... eth4)
# MODE B: as mode A, but eth1/eth2 are combined into a redundant port
# MODE C: as mode B, but eth3/eth4 also combined into a redundant port
[SFP]
MODE = A
```

SFP Mode	Description
Mode A	Ports eth1, eth2, eth3, and eth4 operate as four standalone ports, each with its own IP address, MTU, NTP, PTP, SNMP, and VLAN settings.
Mode B	Ports eth1 and eth2 operate as one HSR/PRP port, and ports eth3 and eth4 operate as two standalone ports.
Mode C	Ports eth1 and eth2 operate as one HSR/PRP port, and ports eth3 and eth4 operate as one HSR/PRP port.

Table 19: Set SFP Mode

## 5.3 Keys (Offline)

The files in this section can also be uploaded as described in section [Upload \(Online\)](#).

```
# certificates and keys for SSH, NTS and HTTPS/websockets
[KEYS]
SSH = novatech
NTS = kronos3
HTTPS = kronos3
```

Use WinSCP or SFTP to upload the .pem files described in the following table to the respective directory in the clock. See section [SFTP Access](#) for details.

Parameter	File Type	Directory	Description
SSH =	.pub	/kronos/keys	Enter the name of the .pub file to use for SSH without the .pub extension. Default: novatech
NTS =	.pem	/kronos/keys	Enter the name of the .pem file to use for NTS without the .pem extension. This .pem file is used when NTP is enabled (see section <a href="#">Port Settings</a> ). Default: kronos3
HTTPS =	.pem	/kronos/keys	Enter the name of the .pem file to use for HTTPS without the .pem extension. Default: kronos3

**Table 20: Key file locations**

## 5.4 General Settings (Offline)

The parameters in this section of the configuration file defined the identifier, location, and contact strings for the unit. These strings are shown on the web-based dashboard and reported as sysName, sysLocation, and sysContact over SNMP. They are also included in all log files. The same settings can be made in the webpage as described in [General Settings \(Online\)](#).

```
# IDENTIFIER, LOCATION and CONTACT are shown on the dashboard web page and
# reported as sysName, sysLocation and sysContact when using SNMP
# Replace with values meaningful to the installation
[GENERAL]
IDENTIFIER = Kronos Series 3
LOCATION = Main Street Substation
CONTACT = James Sullivan 234-567-8901
```

Parameter	Description
[GENERAL]	General parameters are defined in section [GENERAL].
IDENTIFIER	User-defined identifier for the clock, up to 30 characters long. Default: Kronos Series 3
LOCATION	User-defined string for the clock location, up to 30 characters long.
CONTACT	User-defined contact string (email or telephone) for the clock, up to 30 characters long.

**Table 21: General settings**

## 5.5 Display Settings (Offline)

This section configures the information presented on the dot matrix display. The same settings can be made in the webpage as described in [Display Settings \(Online\)](#).

```
# Selects what is shown on the unit's dot matrix display. MODE can be:  

# 1: day-of-year (001 to 356) + HH:MM:SS  

# 2: HH:MM:SS + STD_NAME/DST_NAME of TIMEZONE  

# 3: HH:MM:SS + TIMEZONE OFFSET  

# 4: dd mmm  HH:MM:SS  

# 5: HH:MM:SS + number of satellites used in solution  

[DISPLAY]  

MODE = 4
```

Parameter	Description
[DISPLAY]	The settings are in section [DISPLAY].
MODE	Selects the information that is shown on the dot matrix display during normal operation. Default: 1 (Day-of-year + HH:MM:SS).
MODE = 1	Displays day-of-year (001 to 366) and local time: 
MODE = 2	Displays local time and the appropriate time zone abbreviation (STD_NAME during standard time, DST_NAME during daylight saving time): 
MODE = 3	Displays local time and the current time zone offset (OFFSET during standard time, OFFSET plus one hour during daylight saving time): 
MODE = 4	Displays day-of-month, month, and local time. This is the default setting. 
MODE = 5	Displays local time and the number of satellites used for time calculation: 

Table 22: Display settings

## 5.6 GNSS Settings (Offline)

The parameters GALILEO, GLONASS, and BEIDOU for controlling these constellations can also be made in the webpage as described in [GNSS Settings \(Online\)](#).

The parameters ANT\_DELAY, FAKE\_GNSS, and FAKE\_TIME can only be set in the configuration file.

The parameter ANT\_DELAY compensates the propagation delay in the antenna cable.

It is possible to force the clock to operate in a “fake” mode, where reception of satellite signal and antenna connection are simulated. This can be useful during commissioning work, where the clock is required to operate before antenna installation has been completed.

```
# GNSS related settings
# ANT_DELAY is the antenna cable delay compensation in nanoseconds (~4 ns for
# each meter of coax cable)
# GALILEO, GLONASS and BEIDOU can be set to TRUE/FALSE in order to enable/disable
# the usage of additional constellations
# FAKEGNSS and FAKETIME can be used to simulate antenna connection and GNSS
# signal reception
# (use for commissioning work only, set to FALSE before normal operation !)
[GNSS]
ANT_DELAY = 60
GALILEO = False
GLONASS = False
BEIDOU = False
FORCEGNSS = False
FORCETIME = 2024-05-15 12:00
```

**Note:** TCXO can use GPS, Galileo, and Glonass or BeiDou simultaneously. OCXO can use GPS, and Glonass or BeiDou simultaneously.

**Note:** Switching between GNSS (and especially away from GPS) may affect the long term accuracy of the receiver until the next cold start. In normal operation the receiver selects the best models and corrections from the transmitted auxiliary data (e.g. UTC and ionospheric parameters), basing this selection on the configured GNSS. Disabling a major GNSS prevents auxiliary data from that GNSS being refreshed and so it will become stale, resulting in progressively degraded performance. For this reason, NovaTech recommends that the satellite clock be cold started after any change that disables an active GNSS, within a few weeks, but preferably immediately. This will ensure that the GNSS receiver then uses only regularly refreshed information from the newly configured constellations.

Parameter	Description
[GNSS]	GPS related parameters are defined in section [GPS].
ANT_DELAY	<p>Value (in nanoseconds) that corresponds to the delay introduced by the antenna cable, typically 1.2ns/ft (4ns/m). The exact delay can be computed by:</p> $t = \frac{1}{c \times K_v} \times l$ <p>where</p> <p><math>c = 3 \times 10^8</math> m/s is the light speed</p> <p><math>K_v</math> is the velocity factor of the cable being used</p> <p><math>l</math> is the cable length in meters.</p> <p>Default: 60ns (equivalent to 50ft (15m) antenna cable)</p>
GALILEO GLONASS BEIDOU	Use of these satellite systems can be enabled if desired by setting the respective value to TRUE. Glonass and BeiDou cannot be enabled at the same time. Note that GPS is always enabled. The default value for each is FALSE.
FORCEGNSS	<p>If TRUE, antenna connection and reception of satellite signals is simulated by the unit.</p> <p><b>Note: The time reported by the clock will not be correct if FORCEGNSS is TRUE. Make sure to set FORCEGNSS to FALSE before normal operation. Alternatively, delete or comment out the line from the configuration file.</b></p>
FORCETIME	<p>If a date and time are entered, the clock uses and displays the entered date and time and counts up time from there instead of using the satellite signal. This is useful for testing.</p> <p>Example: 2023-01-01 12:00</p> <p><b>Note: The time reported by the clock will not be correct if date and time are entered for FORCETIME. Make sure to remove date and time for normal operation. Alternatively, delete or comment out the line from the configuration file.</b></p>

Table 23: GPS receiver settings

## 5.7 Out-of-bound Limits (Offline)

The parameters in this section configure the user defined out-of-bounds limits. All values are in milliseconds. Valid values are from 0.001ms (1 microsecond) to 4000ms (4 seconds). See section [Clock States](#) for an explanation of how these limits affect clock operation. The same settings can be made in the webpage as described in [GNSS Settings \(Online\)](#).

```
# User defined out-of-bounds limits (in miliseconds)
# Valid values are from 0.001 (1 microsecond) to 4000 (4 seconds)
[LIMITS]
LOWQUALITY = 0.5
BADTIME = 1000
```

Parameter	Description
[LIMITS]	Out-of-bounds limits are defined in section [LIMITS].
LOWQUALITY	When the time becomes inaccurate by more than the time specified value, the LOWQUALITY alarm is set. The range is 0.001 to 4000ms. Default: 0.5ms
BADTIME	When the time becomes inaccurate by more than the time specified value, the BADTIME alarm is set. The range is 0.001 to 4000ms. Default: 1000ms

Table 24: Out-of-bound limit settings

## 5.8 Time Zone Settings (Offline)

The parameters in this section configure the clock to derive local time from UTC. If a daylight saving time (DST) rule is specified, daylight savings time changes will be performed automatically. The same settings can be made in the webpage as described in [Time Zone Settings \(Online\)](#).

```
# Timezone and daylight saving time rules
# In order to disable DST, specify DST_RULE = NONE
[TIMEZONE]
OFFSET = +06:00
STD_NAME = CST
DST_NAME = CDT
DST_RULE = US
DST_BEGIN = M3.2.0/2:00
DST_END = M11.1.0/2:00
```

Parameter	Description
[TIMEZONE]	Time zone parameters are defined in section [TIMEZONE].
OFFSET	OFFSET is the time value that has to be added to the local time to get UTC during standard (not daylight saving) time. OFFSET is positive if the local time zone is west of the Prime Meridian and negative if it is east.
STD_NAME	Time zone abbreviation during standard time. Should not be shorter than three letters. Only the first four letters are used. Default: UTC
DST_NAME	Time zone abbreviation during daylight saving time. Only the first four characters are used. Default: blank

Parameter	Description
DST_RULE	During daylight saving time, local time is one hour ahead of standard time. DST_RULE should be one of NONE, US, EUROPE (or EUROPE_C), EUROPE_W, EUROPE_E, BRAZIL, or CUSTOM. See <a href="#">Appendix C – Daylight Saving Time Rules</a> for details about each of the daylight saving time rules above. Default: NONE.
DST_BEGIN	Only used if DST_RULE = CUSTOM. See section User-Defined DST Rule for syntax.
DST_END	Only used if DST_RULE = CUSTOM. See section User-Defined DST Rule for syntax.

Table 25: Time settings

Example: Configuration for a clock in Central Europe

```
[TIMEZONE]
OFFSET = -01:00 ; one hour east of Greenwich
STD_NAME = CET ; central European time
DST_NAME = CEST ; central European summer time
DST_RULE = Europe
```

## 5.9 PTP Settings (Offline)

This section configures the PTP parameters for the clock's SFP ports as well as configured HSR/PRP ports.

The same settings can be made in the webpage as described in [PTP Settings \(Online\)](#).

**Note:** It is recommended to configure PTP on the webpage since all values are preset to match the selected profile.

**Note:** If multiple interfaces are set up with a Power profile, then the Grandmaster ID for each interface must be set to a different value. If interfaces using a Power profile are set to the same Grandmaster ID, then PTP will work on only one of those interfaces.

```
# Settings for the Precise Time Protocol on eth1
[PTP1]
domainNumber          = 0
priority1             = 128
priority2             = 128
logAnnounceInterval  = 0
logSyncInterval       = 0
logMinDelayReqInterval = 0
logMinPdelayReqInterval = 0
announceReceiptTimeout = 2
delay_mechanism       = P2P
hybrid_e2e             = False
network_transport      = L2
udp_ttl                = 1
inhibit_multicast_service = False
unicast_listen          = False
unicast_req_duration   = 3600
```

```

dataset_comparison          = ieee1588
G.8275.defaultDS.localPriority = 128
G.8275.portDS.localPriority = 128
power_profile_tlv_enabled   = True
grandmaster_id              = 3
transportSpecific            = 0
ptp_dst_mac                 = 01:1B:19:00:00:00
p2p_dst_mac                 = 01:80:C2:00:00:0E

```

## 5.10 SNMP Settings (Offline)

This section configures the built-in SNMP agent. The same settings can be made in the webpage as described in [SNMP Settings \(Online\)](#).

SNMP can be enabled for each port individually. There are separate configurations for SNMPv1, SNMPv2c, and SNMPv3 protocol versions. The configurations apply the same to all enabled ports.

The associated MIB (SNMP Management Information Base) file can be downloaded using a web browser from the device's HTTP dashboard.

```

# SNMP parameters: there are separate sections for versions 1, 2c and 3.
# Uncomment to enable.
[SNMPv1]
RO_COMMUNITY = PRIVATE

[SNMPv2c]
RO_COMMUNITY = PRIVATE
TRAP_COMMUNITY = secret.trap.community
TRAP_HOST1 = 172.16.0.10
TRAP_HOST2 = 172.16.0.20

[SNMPv3]
AUTH_NAME = whatever.you.want
AUTH_KEY = very.secret.password
AUTH_PROTOCOL = SHA

```

Parameter	Description
[SNMPv1]	Section name for SNMPv1 parameters.
RO_COMMUNITY	Community string for SNMPv1. Default: blank (access is disabled)
[SNMPv2c]	Section name for SNMPv2c parameters.
RO_COMMUNITY	Community string for SNMPv2c. Default: blank (access is disabled)
TRAP_COMMUNITY	Trap community name for SNMPv2c traps.
TRAP_HOST1 TRAP_HOST2	IPv4 trap destination address (or addresses), specified in the form a.b.c.d.
[SNMPv3]	Section name for SNMPv3 parameters.

Parameter	Description
AUTH_NAME	User name for read-only access using SNMPv3. Default: blank (access is disabled)
AUTH_KEY	Password for read-only access using SNMPv3.
AUTH_PROTOCOL	Authentication protocol to use when validating AUTH_NAME and AUTH_KEY. Possible values are MD5 or SHA. Default: MD5

**Table 26: SNMP settings**

## 5.11 Syslog (Offline)

This section configures the syslog. The same settings can be made in the webpage as described in [Syslog \(Online\)](#).

```
# Settings for remote syslog
# Leave TARGET_A or TARGET_B empty if only one remote syslog server is used
[SYSLOG]
LEVEL = NOTICE
TARGET_A =
PORT_A = 514
PROTOCOL_A = UDP
TARGET_B =
PORT_B =
PROTOCOL_B = UDP
```

Parameter	Description
[SYSLOG]	Section name for syslog settings.
LEVEL	Select the desired priority (see <a href="#">Table 16</a> ) for sending syslog messages. The set priority includes all higher priorities. The highest priority that can be set in Series 3R is Error which automatically includes Critical, Alarm, and Emergency.
TARGET_A	IP address of the primary syslog server.
PORT_A	Port used by the primary syslog server.
PROTOCOL_A	Protocol used by the primary syslog server. Select TCP or UDP.
TARGET_B	IP address of the secondary syslog server.
PORT_B	Port used by the secondary syslog server.
PROTOCOL_B	Protocol used by the secondary syslog server. Select TCP or UDP.

**Table 27: Syslog settings**

## 5.12 Network Settings (Offline)

This section configures the network parameters for the clock's Ethernet ports. The clock has one RJ45 Ethernet port and four SFP slots.

The same settings can be made in the webpage as described in [Network Settings \(Online\)](#).

```
[NETWORK]
# CHANGEIP enables/disables changing the IP address of eth0 using the rotary
# knob on the front panel (see user manual for details)
GATEWAY = 192.168.0.254
CHANGEIP = True

[ETH0]
ADDR = 192.168.0.1
MASK = 255.255.0.0
MTU = 1500
NTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH1]
# REDUNDANCY_MODE is ignored if SFP_MODE = A
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1494
REDUNDANCY_MODE = PRP
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH2]
# Settings for ETH2 are ignored if SFP_MODE = B or C
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1500
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH3]
# REDUNDANCY_MODE is ignored if SFP_MODE = A or B
# Leave ADDR empty to disable port
ADDR =
MASK =
```

```

MTU = 1494
REDUNDANCY_MODE = PRP
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH4]
# Settings for ETH4 are ignored if SFP_MODE = C
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1500
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

```

Item	Description
GATEWAY	Enter the IP address of the gateway used by the clock.
CHANGEIP	<p>TRUE     Enable changing the IP address of port eth0 via the rotary knob.</p> <p>FALSE    Disable changing the IP address of port eth0 via the rotary knob.</p> <p>See <a href="#">Change Using Front Rotary Knob</a> for details.</p> <p>Default: True</p>

**Table 28: Network settings**

Configure the following parameter for each Ethernet port.

Item	Description
IP address	Set the IP address of the port.
Netmask	Set the netmask of the port.
MTU	Maximum Transmission Unit sets the largest size in bytes of a packet that can be transmitted over the port in a single transaction.
Redundancy Mode (if eth1/eth2 or eth3/eth4 are set to HSR/PRP in <a href="#">Figure 17</a> )	<p>Set the redundancy for eth1/eth2 or eth3/eth4..</p> <p>HSR     HSR redundancy</p> <p>PRP    PRP redundancy</p>
NTP Enable	Check this box to enable NTP on the port.
PTP Enable	Check this box to enable PTP on the port. Select the PTP profile in <a href="#">PTP Settings (Online)</a> .
SNMP Enable	Check this box to generate SNMP messages for this port.

Item	Description
VLAN Enable	Check this box to enable VLAN on this port.
VLAN ID	Set the VLAN ID.
VLAN Priority	Set the VLAN priority

Table 29: Ethernet port settings

## 5.13 Output Settings (Offline)

This section configures the timing signals that will be generated for the outputs of the clock. The length of the section depends on the number of outputs. The same settings can be made in the webpage as described in [Output Settings \(Online\)](#).

The four outputs on the -4 quad output card are configured in pairs, so the -4 card uses only two OUTPUT sections instead of four. For example, the -4 card is in slot 1, then the card is represented by sections OUTPUT1 and OUTPUT2 in the .cfg file, and the outputs are labeled 1a/1b and 2a/2b on the back of the clock.

Note that the POLARITY can only be set in the configuration file and not in the webpage.

See [Appendix A – Options List](#) for information about how to interpret the part number and determine the number and type of outputs available in your unit.

```
# Signal generation on OUTPUT1 .. OUTPUT6
[OUTPUT1]
# OPTIONS = OFF, IRIG-B000, IRIG-B002, IRIG-B004, IRIG-B006, PPS, PPM
SIGNAL = IRIG-B004
TIME = LOCAL
POLARITY = NORMAL

[OUTPUT2]
# OPTIONS = OFF, IRIG-B120, IRIG-B122, IRIG-B124, IRIG-B126
SIGNAL = IRIG-B124
TIME = LOCAL
POLARITY = NORMAL
```

Parameter	Description				
[OUTPUTn]	Outputs are defined in section [OUTPUTn].				
SIGNAL	Configures the type of signal that will be generated on OUTPUTn. Valid values are:				
Card Name	Card Type	Signals			
-1	Single unmodulated output	OFF			
-2	Dual unmodulated outputs	PPM			
-4	Quat unmodulated outputs	PPS			
-F	Dual fiber outputs	IRIG-B000 IRIG-B002 IRIG-B004 IRIG-B006			
-A	Dual modulated outputs	OFF IRIG-B120 IRIG-B122 IRIG-B124 IRIG-B126			
Default: OFF					
Time UTC Local	The output can be set to send either UTC time or local time.				
POLARITY	Configures the polarity of the signal at OUTPUTn. Valid values are NORMAL and INVERTED. Default: NORMAL				

Table 30: Output signals

## 6 SFTP Access

The clock supports SFTP (Secure File Transfer Protocol) for accessing the configuration file, firmware upgrades, and uploading key files. The SFTP server runs on port 22 (default port for SFTP).

The following usernames are predefined:

Username	Default Password	Files	Description
cfg	novatech	Kronos3.cfg (read/write) Kronos3.default (read only)	Active configuration file  Default configuration file. When the reset button on the back of the clock is pressed, then this file is copied to kronos3.cfg.
upl	novatech	.fwu .pub .pem	Upload new firmware (.fwu) or key files (.pem, .pub). See <a href="#">Appendix D – Firmware Update Procedure</a> and/or <a href="#">Keys (Offline)</a> .

Table 31: Default SFTP usernames and passwords

**Note:** It is recommended to change the default passwords at commissioning as described in section [Access Passwords \(Online\)](#).

This requires a SFTP client on the engineering PC. A SFTP client such as FileZilla ([www.filezilla.org](http://www.filezilla.org)) or WinSCP ([www.winscp.net](http://www.winscp.net)) can be downloaded from the respective website. You can download an installation package or use the “portable” executable if available.

When the program is started, you will be prompted for a hostname, username, and password ([Figure 29](#)).

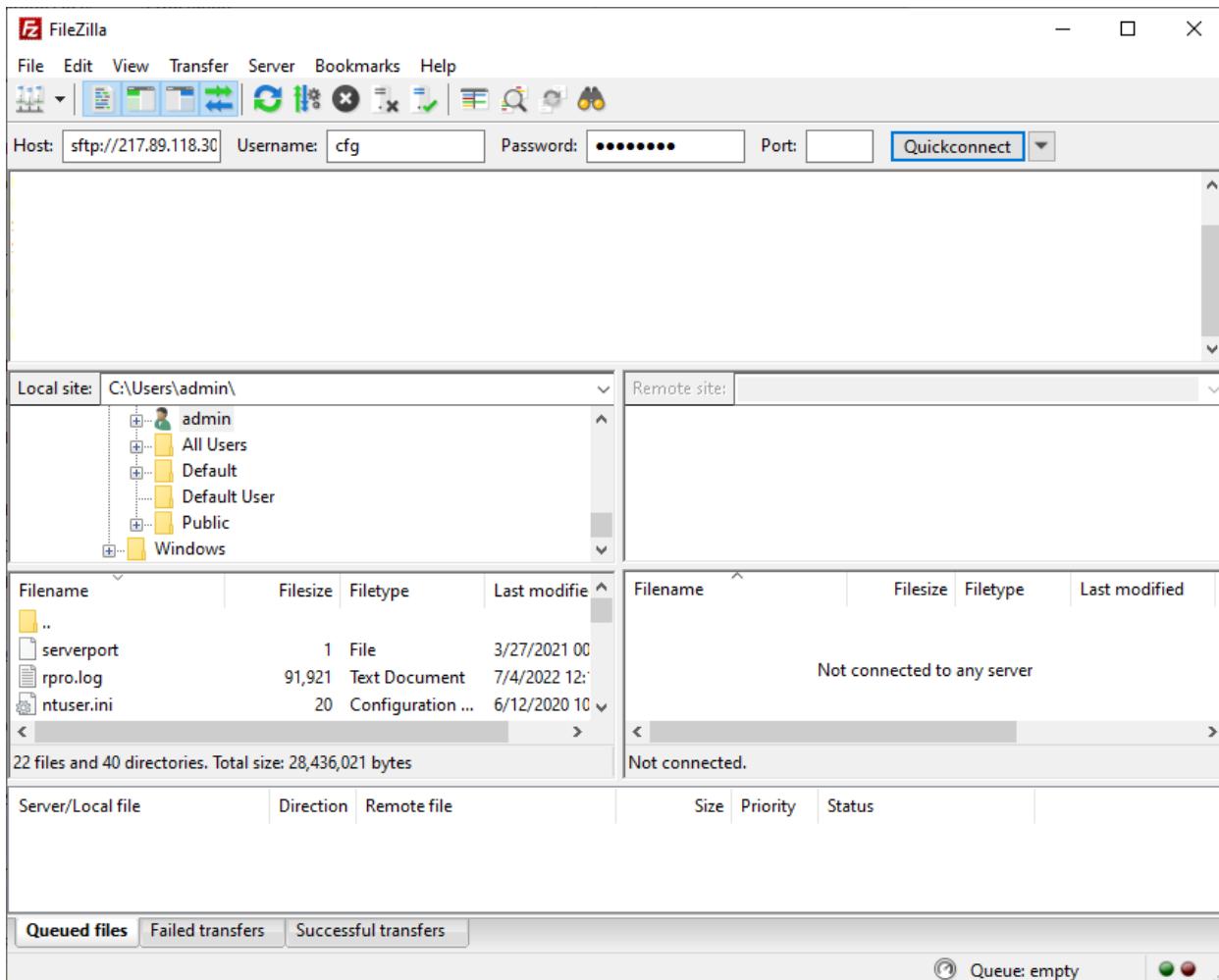


Figure 29: FileZilla

Field	Description
Host	Enter the IP address of the clock. The IP address is displayed briefly at the end of the boot sequence.
Username	Enter the appropriate user name. See also <a href="#">Table 31</a> .
Password	Enter the appropriate password. See also <a href="#">Table 31</a> .
Port	For SFTP, use 22.

Table 32: FileZilla parameters

After entering hostname, username, and password, click the **Login** button.

If this is the first time that the SFTP client is connecting to this particular clock, you will see a warning about this being an “unknown server”.

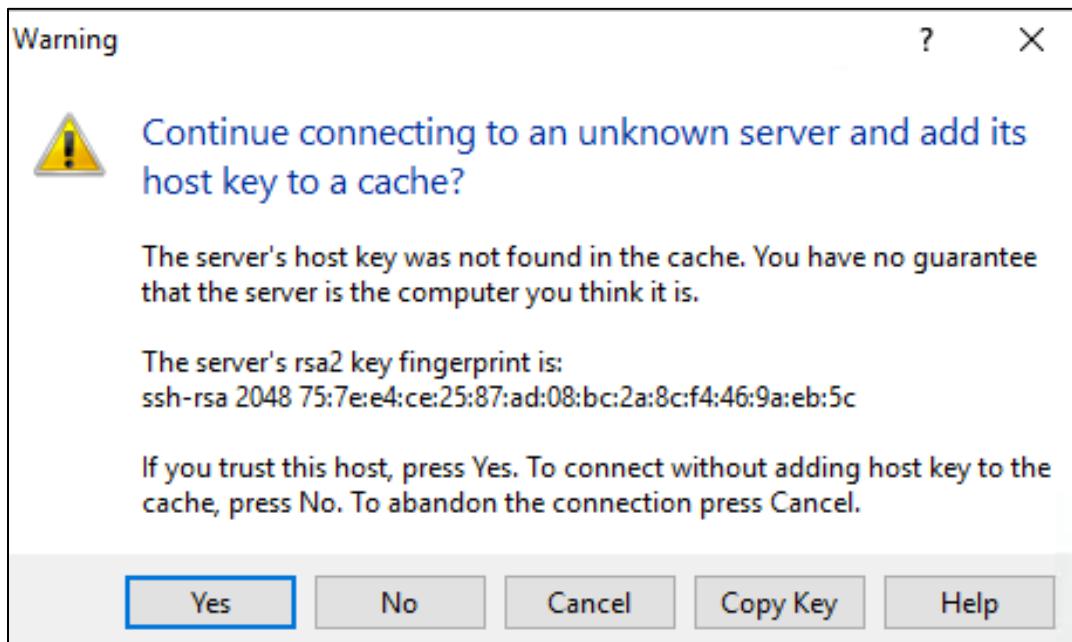


Figure 30: Unknown server warning message

Click **Yes** to add the host key to the cache of known keys.

After accepting the clock's fingerprint you will see a screen similar to Windows Explorer. On the left side are the files stored locally on your computer and on the right are the files on the clock.

You can click and drag from either window to copy files between your computer and the clock.

You can also use the built-in editor to edit the configuration file on-line. Changes in the configuration file become active as soon as the file is saved or closed.

You can also use other SFTP clients based on your preferences and computer's operating system. Other SFTP clients operate similarly to the description in this section.

## 7 Troubleshooting and Maintenance

### 7.1 Troubleshooting

The following table shows troubleshooting steps for various scenarios.

Scenarios	Possible causes
ant. open displayed Alarm LED is on	<ul style="list-style-type: none"><li>▪ No antenna connected</li><li>▪ Antenna cable defective</li><li>▪ Surge arrester defective</li><li>▪ Wrong antenna connected</li></ul>
ant. short displayed Alarm LED is on	<ul style="list-style-type: none"><li>▪ Short-circuit in antenna cable or connection</li><li>▪ Antenna cable defective</li><li>▪ Surge arrester defective</li><li>▪ Wrong antenna connected</li></ul>
bad time displayed Alarm LED is on	<ul style="list-style-type: none"><li>▪ Poor antenna location</li></ul>

Table 33: Troubleshooting scenarios

### 7.2 Cleaning



**Before cleaning the clock make sure that the primary voltage has been disconnected.**

Should it be necessary to clean the exterior of the clock, use only a dry cloth.

To avoid damages to the electrostatically sensitive electronic parts, no cleaning of internal parts should be performed.

## Appendix A – Options List

The Kronos Series 3R is available with the following options. Positions 8 to 11 (in light gray) are not printed on the label on the Kronos enclosure.

Model		Power Supply 1	Power Supply 2	Oscillator	Antenna Connector	Expansion Card 1	Expansion Card 2	Expansion Card 3	Description
Kronos 3R	-		-	-	-				Rack mount satellite clock, includes 1 RJ45, 4 SFP slots, 10' coax cable and surge arrestor
	HV	HV	-	-	-				80-300V dc/85-264V ac power supply
	LV	LV	-	-	-				18-60V dc power supply
	XX	-		-	-				No redundant power supply
		TCXO	-	-					Standard temperature compensated oscillator
		OCXO	-	-					Optional oven-controlled oscillator
		[ ]	-						Standard TNC connector [no digits added to model #]
		F75	-						Dual antenna connectors (TNC and F-type, available to use either)
			A	A	A	-			Dual modulated output card
			1	1	1	-			Single unmodulated output card
			2	2	2	-			Dual unmodulated output card
			4	4	4	-			Quad unmodulated output card
			F	F	F	-			Dual fiber output card
			X	X	X	-			Empty expansion slot

Table 34: Series 3R clock order information

The following table shows the accessories. For ordering purposes, append that string to the part number generated in [Table 34](#).

Optional SFP Transceivers, up to 4 total X represents quantity for each type [bracketed items only inserted if at least 1 is selected]							Antenna	Antenna Cable	Antenna Mount	Description
[ ]	-	[ ]	-	[ ]	-	[ ]	-	-	-	
[MM1X]	-		-		-		-	-	-	SFP-MM01, multimode, LC, 550m, 850nm, 1Gbps
		[SM1X]	-		-		-	-	-	SFP-SM01, single mode, LC, 10km, 1310nm, 1Gbps
			[SM4X]	-		-	-	-	-	SFP-SM04, single mode, LC, 40km, 1310nm, 1Gbps
				[RJ1X]	-		-	-	-	SFP-RJ01, RJ45, 100m, 1Gbps
					AU	-	-	-	-	Universal Antenna
					XX	-	-	-	-	No antenna
						C015	-	-	-	Antenna cable 15' (4.5m) – RG58
						C030	-	-	-	Antenna cable 30' (9m) – RG58
						C050	-	-	-	Antenna cable 50' (15m) – RG58
						C080	-	-	-	Antenna cable 80' (25m) – RG58
						C200	-	-	-	Antenna cable 200' (60m) – LMR400
						XXXX	-	-	-	No antenna cable
							MT	-	-	Antenna Mount for Universal Antenna (AU)
							XX	-	-	No antenna mount

Table 35: Series 3R accessories order information

Example:

Kronos-3R-HVHV-OCXO-F75-A1X-MM12-RJ12-AU-C050-MT

With:

- 1 ea surge arrester (standard)
- 1 ea 10ft antenna cable (standard)
- 2 ea -HV power supplies
- OCXO oscillator
- F-type antenna port (in addition to TNC antenna port)
- 1 ea -A card
- 1 ea -1 card
- 2 ea MM1 SFP transceivers
- 2 ea RJ1 SFP transceivers
- 1 ea universal antenna
- 1 ea 50 ft antenna cable
- 1 ea antenna mount

## Appendix B – Technical Specifications

The clock has the following technical specifications.

Item	Specification
Unit Dimensions	19"W x 1.73"H x 7.7"D (483 x 44 x 155mm)
Mounting/Front Panel Height	19" Rack / 1 RU
Housing Material	Aluminum
Degree of Protection	IP40-rated enclosure protection
Weight	5.5 lb (2.5 kg)

Table 36: General Data

Item	Specification
Supply Voltage Range	18-60V dc or 80-300V dc / 86-264V ac (50/60 Hz)
Max Power Consumption	30VA
Redundant Power Supply	Optional

Table 37: Power Supply

Item	Specification
LED	Locked (Green) Holdover (Yellow) Alarm (Red)
Display	Red Dot Matrix Display (5.0"x0.7"/127x18mm)

Table 38: Indicators

Item	Specification
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Storage Temperature	-40°C to +70°C (-40°F to +158°F)
Humidity	5% to 95%, non-condensing
Altitude	2000m

Table 39: Environmental

Item	Specification
Supported IRIG-B Protocols	B000/B002/B004/B006
Connector Type / Quantity	Pluggable compression screw terminal (twisted pair): up to 6 BNC female (coax): up to 12 ST (fiber): up to 6
Electrical Performance (twisted pair, coax)	200 mA drive capability at 5V level Up to 160 ft. (50 m) cable 15 Ω output impedance Fully-isolated
Optical Performance (fiber)	820nm wavelength Optical power: -15.8 dBm into 50/125 μm fiber (-12 dBm into 62.5/125 μm fiber)

**Table 40: Unmodulated IRIG-B**

Item	Specification
Supported IRIG-B Protocols	B120/B122/B124/B126
Connector Type / Quantity	BNC female (coax): up to 6
Electrical Performance (twisted pair, coax)	5V pp (no load) / 3.2V pp (50 Ω load) output voltage 25 Ω output impedance

**Table 41: Modulated IRIG-B**

Item	Specification
Connector Type	1 RJ45 10/100/1000BaseT Ethernet Port 4 SFP slots (SFP transceivers optional)
Protocols	VLAN IEEE 802.1Q IEEE1588-2008V.2 (PTPv2) NTP/SNTP SNMP Syslog HSR/PRP (IEC 62439-3) MQTT HTTPS

**Table 42: Ethernet**

Item	Specification
GNSS Receiver	Multi-constellation 72-channel L1-C/A (1575.42 MHz) GPS signal E1-B/C (1575.42 MHz) Galileo L1OF (1602 MHz) GLONASS B1 (1561.098 MHz) BeiDou Note: TCXO supports GPS, Galileo, and GLONASS or BeiDou simultaneously OCXO supports GPS, and GLONASS or BeiDou simultaneously
Antenna Connector Type	TNC (female), 50 Ω / Optional F-type (female), 75 Ω
Antenna Type	Active
Holdover Oscillator	TCXO (standard): 0.1 ppm (approx. 8.64ms/24hrs) typical drift OCXO (optional): 1 ppb (approx. 8.64us/24hrs) typical drift
Tracking Sensitivity	-166dBm

**Table 43: GNSS interface**

Item	Specification
PTP Profiles	UDP 802.3 IEEE C37.238-2011 (Power Profile) IEEE C37.238-2017 (Power Profile) IEC 61850-9-3 (Utility Profile) Telecom G.8265.1 Telecom G.8275.1 Telecom G.8275.2 Custom
Alarm Dry Contact	Type C / Breaking Capacity: 300mA @ 300V dc (resistive load)
Additional Features	Built-in SNMP agent, with trap generation User-configurable rules for daylight saving time (DST) Antenna cable open and short-circuit detection PPS/PPM signal

**Table 44: Functions**

Item	Specification
Country of Origin	USA
HS Code	8517.62

**Table 45: Export information**

## Antenna

The clock comes with a standard TNC port. If option -F75 is ordered, an additional F-type port is available.

The NovaTech antenna has the following specifications.

- Multi-constellation: GPS, Glonass, Galileo, Beidou
- Out-of-band rejection
- 26dB gain
- Low noise < 2.0dB
- TNC port
- 50Ω impedance
- 2.8-6.0V dc operating voltage
- Less than 25mA operating current
- Operating temperature range: -40°C to +85°C
- IP 67 enclosure

NovaTech offers the following antenna (-AU) and antenna mount (-MT). All shown measurements are inches.

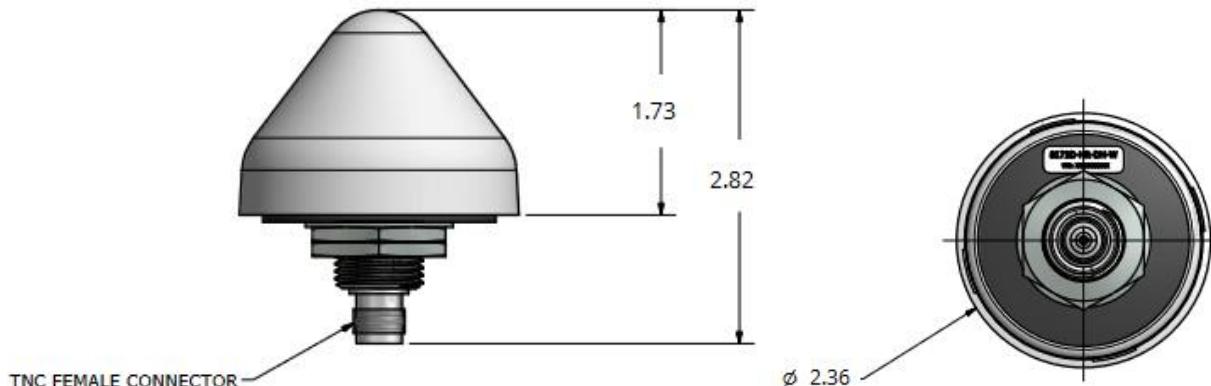


Figure 31: Antenna measurements

The antenna is mounted on the mounting bracket shown in [Figure 32](#). The antenna mount allows mounting on walls as well as on poles.

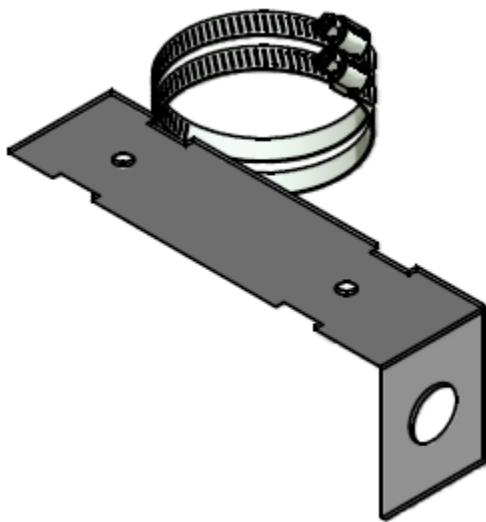


Figure 32: Antenna mount (3D view)

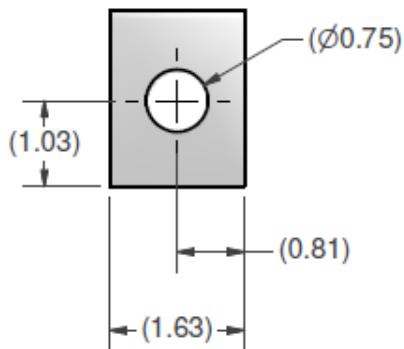


Figure 33: Antenna mount (top view)

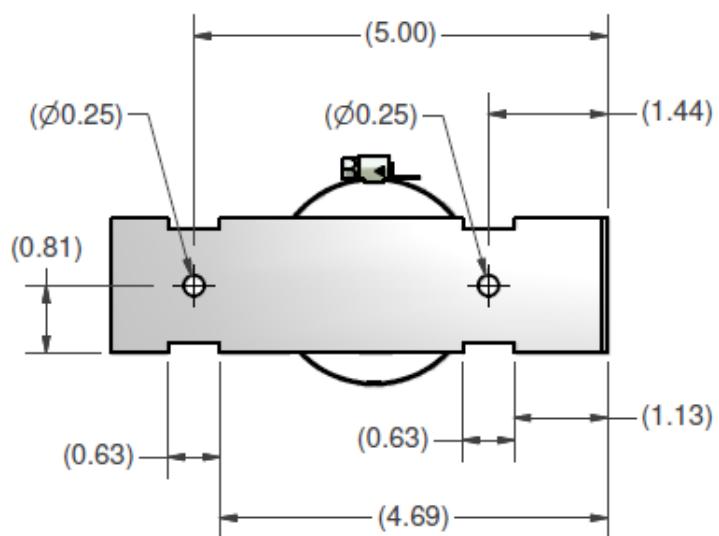
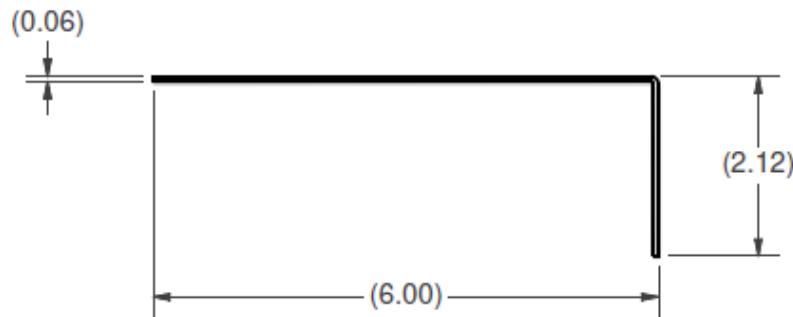


Figure 34: Antenna mount (rear view)



**Figure 35: Antenna mount (side view)**

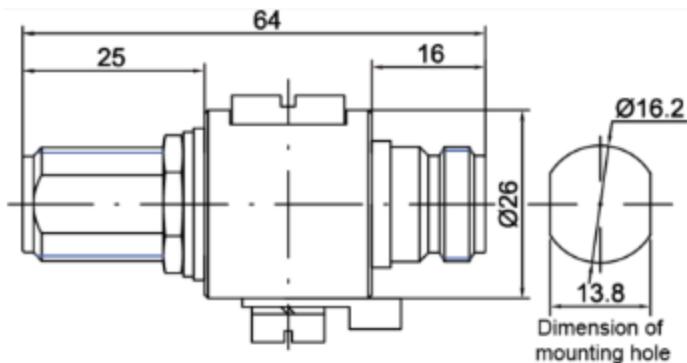
If another antenna is used, it must meet the following specifications:

- Multi-constellation: GPS, Glonass, Galileo, Beidou
- TNC port or F-type port
- 50Ω or 75Ω impedance
- 4.5V dc operating voltage
- Less than 100mA operating current
- Operating temperature range: -40°C to +85°C
- IP 67 enclosure

## Surge Arrester

The surge arrester is a 4GHz bi-directional coaxial surge water-proof suppressor with high energy gas discharge tube which can be replaced in a field. It can be mounted through-hole or using a bracket.

- Frequency range: DC to 4GHz
- Insertion loss: < 0.2dB
- Return loss: ≥ 20dB
- Nominal discharge current: 5kA
- Temperature range -50°C to 85°C
- IP 67 and NEMA 6P
- UL 497E



**Figure 36: Surge arrester dimensions (in millimeter)**

## Appendix C – Daylight Saving Time Rules

### Western European Summer Time

Known as British Summer Time (BST) in the United Kingdom. Daylight saving time starts at 01:00 local time on the last Sunday in March and ends at 02:00 local time on the last Sunday in October.

Selected by using

```
DST_RULE = EUROPE_W
```

in the configuration file.

### Central European Summer Time

Daylight saving time starts at 02:00 local time on the last Sunday in March and ends at 03:00 local time on the last Sunday in October.

Selected by using

```
DST_RULE = EUROPE
```

or

```
DST_RULE = EUROPE_C
```

in the configuration file.

### Eastern European Summer Time

Daylight saving time starts at 03:00 local time on the last Sunday in March and ends at 04:00 local time on the last Sunday in October.

Selected by using

```
DST_RULE = EUROPE_E
```

in the configuration file.

### North American DST Rule

Daylight saving time starts at 02:00 local time on the second Sunday in March and ends at 02:00 local time on the first Sunday in November.

Selected by using

```
DST_RULE = US
```

in the configuration file.

## Brazilian DST Rule

Daylight saving time starts at 00:00 local time on the third Sunday in October and ends at 00:00 local time on the third Sunday in February.

Selected by using

```
DST_RULE = BRAZIL
```

in the configuration file.

Brazilian DST rule provides an exception should DST end during Carnival, stating that “details will be decided in time”. For this type of exception, use a custom DST rule, see section [User-Defined DST Rule](#) for details.

## User-Defined DST Rule

To use a custom DST rule, place the following in the configuration file:

```
DST_RULE = CUSTOM
```

Additionally, values for DST\_BEGIN and DST\_END also have to be defined. These values can be specified using relative dates (“3rd Sunday in October”) or fixed dates (“the 3rd of March”).

For the specific syntax, see the following sections.

### Begin / End Using Relative Dates

Use a value in the form

m.w.d/hh:mm

to specify day d of week w of month m. Day d must be between 0 (Sunday) and 6 (Saturday). Week w must be between 1 and 5; week 1 is the first week in which day d occurs, and week 5 specifies the last d day in the month. The month m should be between 1 (January) and 12 (December). Time hh:mm should be specified as local time. DST should begin at 02:00

Example: on the second Sunday in March and end at 02:00 on the last Friday in October:

```
DST_RULE = CUSTOM
DST_BEGIN = M3.2.0/02:00 ; second Sunday in March
DST_END = M10.5.5/02:00 ; last Friday in October
```

## Begin / End on Fixed Dates

Use a value in the form

Jnnn/hh:mm

to specify the ordinal day-of-year (also referred to as Julian day) and the local time at which the change to/from DST should occur. nnn should be in the range 001 to 365. February 29 is never counted, even in leap years.

Example: DST should begin at 02:00 on the 1st of March and end at 00:30 on the 30th of October:

```
DST_RULE = CUSTOM  
DST_BEGIN = J060/02:00 ; 1st Mar is ordinal day 60  
DST_END = J304/00:30 ; 30rd Oct is ordinal day 304
```

## Appendix D – Firmware Update Procedure

The Kronos firmware can be updated in the field. NovaTech's [Support Site](#) provides the firmware to download for performing the update. The update can be performed with the procedure in this section, or as described in section [Upload \(Online\)](#).

The latest .fwu file is available on the NovaTech Support Site at [https://support.novatechautomation.com/kronos/?model=series\\_3r](https://support.novatechautomation.com/kronos/?model=series_3r). If you need login credentials, contact [support@novatechautomation.com](mailto:support@novatechautomation.com).

**Note:** After the new firmware is uploaded to the clock, the clock will restart automatically and run the updated firmware. Starting with version 02.02.00, power-cycling is no longer required.



Do not power-cycle or restart the clock during the update process. Such action will interrupt the update process and usually requires returning the clock to the factory. The update process completes with either a “Success” or “Failure” message as described in this manual. If the update process takes longer than expected, contact NovaTech Technical Support at (913) 451-1880.

The current Kronos firmware version is displayed as **Firmware Version** under **General** on the left side of the Kronos dashboard. Access the dashboard by entering the IP address of the clock in the web browser ([Figure 38](#)).

If necessary, the IP address can be determined by pressing the knob on the front of the clock. Then the IP address will be displayed for a few seconds ([Figure 37](#)).

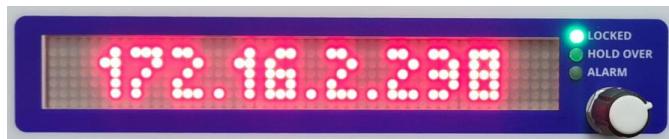


Figure 37: Determine IP address

If the dashboard is password-protected, first a window is displayed for entering the password. Enter your custom password. In case the password has not been changed from the factory setting, the default password is novatech. Then the dashboard is displayed.

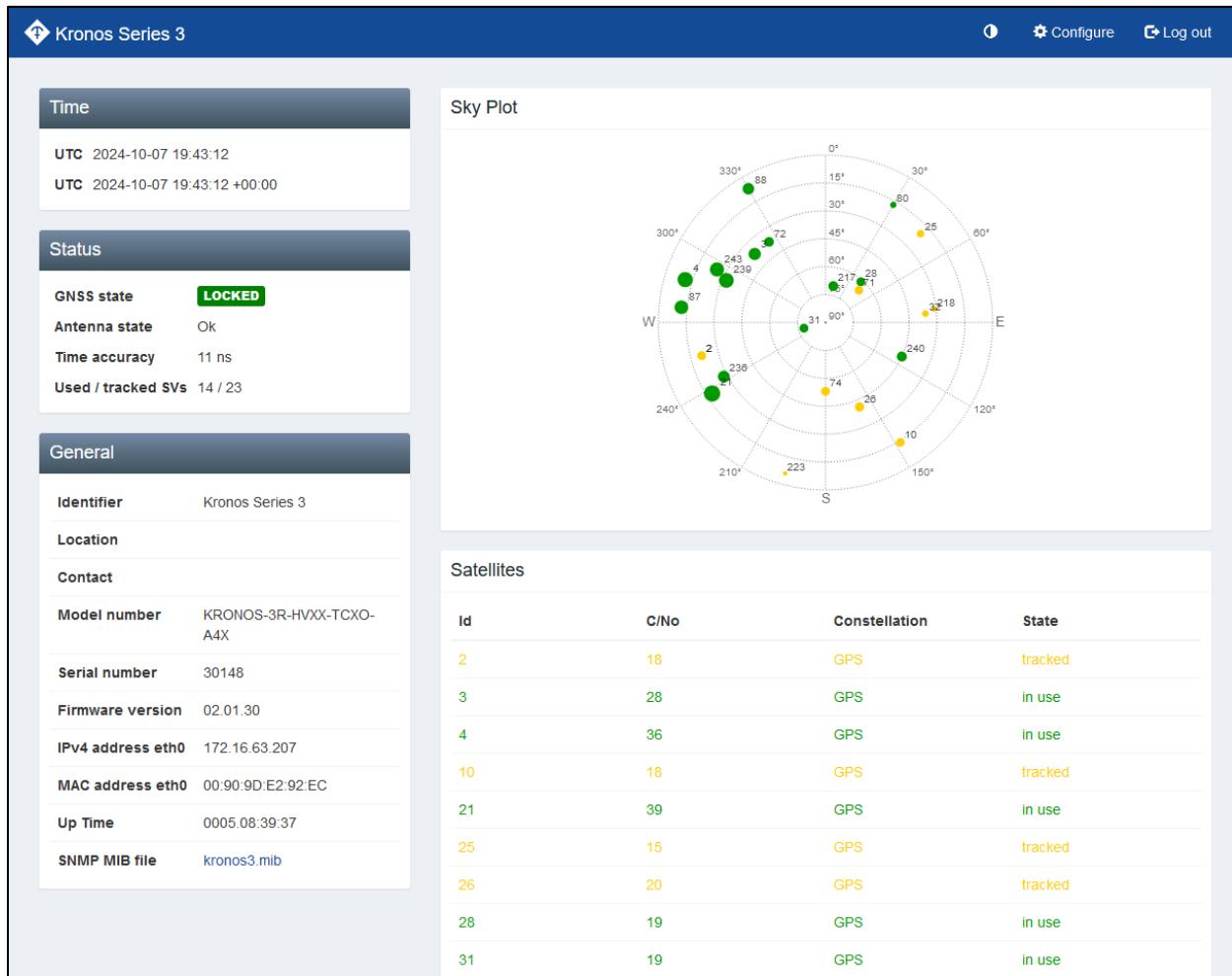


Figure 38: Kronos firmware version on dashboard

If the support site has a newer firmware version available than is running in the Kronos clock, check the release notes for applicability to your issue and download the new firmware.

Use a SFTP client such as FileZilla to upload the new firmware to the Kronos clock. After a power cycle, the firmware procedure installation is automatically started.

1. Using the SFTP client, log in to the clock as user `upl` using your firmware update password. The default password is `novatech`. Make sure to prefix the clock's IP address with `sftp://` or manually set the port number to `22`.

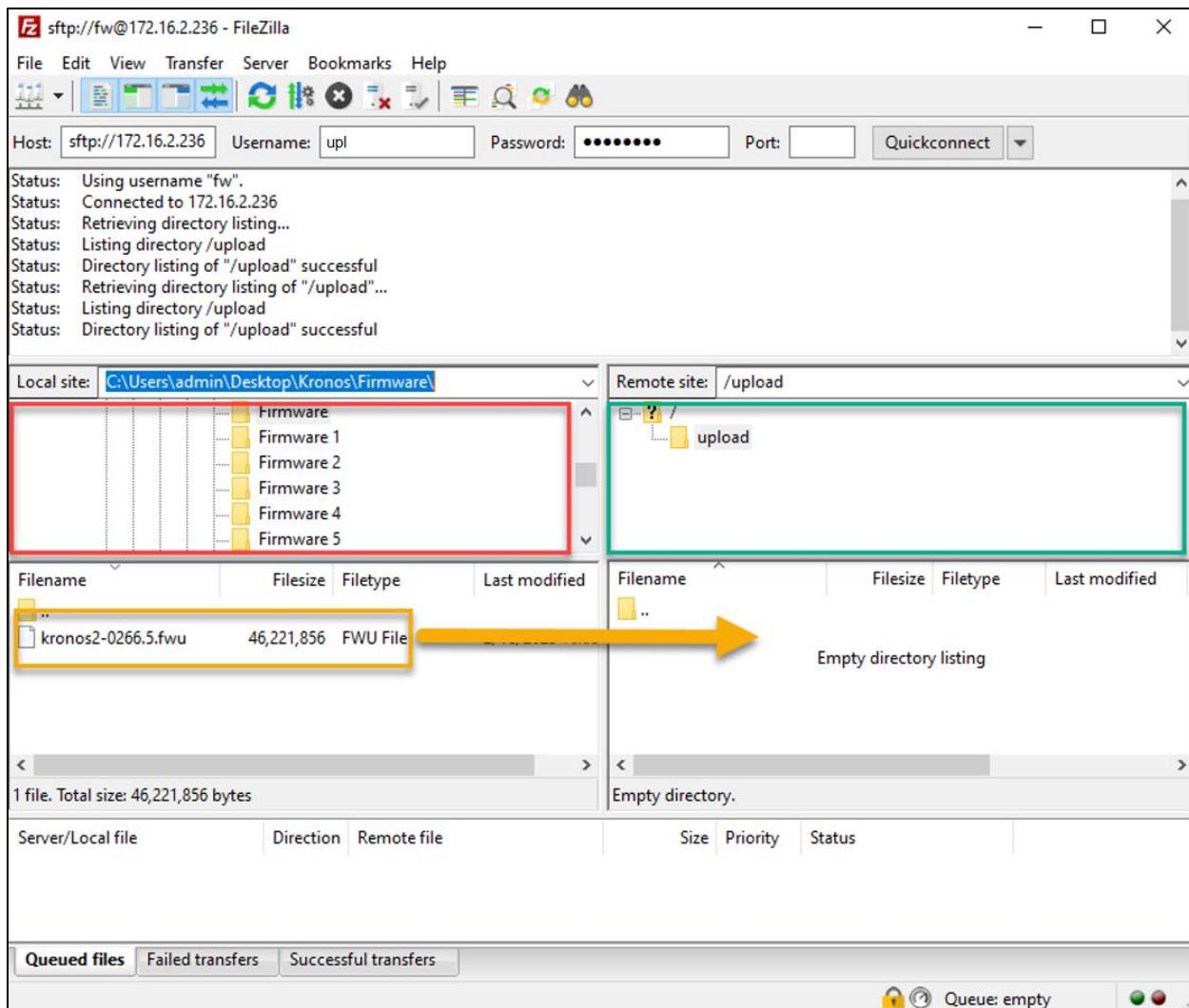


Figure 39: Upload the new firmware

3. After you connect to the clock, the SFTP client displays the above or a similar window. The green frame points to the correct directory in the clock. In the red frame, navigate to the directory on your PC where the new firmware is located. This file will be displayed in the orange window. Then drag-and-drop the file to the pane that the orange arrow points to. Then the new firmware will be uploaded to the clock.
4. Once the upload is complete, turn off the clock.
5. Wait 10 seconds.
6. Turn the clock on again. The clock will show the firmware version and the progress bar, as usual.
7. At the end of the startup sequence, the dot matrix display will show the following messages in order:

FW UPGRADE

Unpack

Verify

Install

Done.



Figure 40: Firmware upgrade completed

8. Turn the clock off again.
9. Wait 10 seconds.
10. Turn the clock on again. The clock should show the new firmware version on the dot matrix display and start as usual.

## Possible Error Messages

Error Message	Description
ERROR 01	Checksum invalid, file corrupted. Download the file from <a href="https://support.novatechautomation.com">https://support.novatechautomation.com</a> again.
ERROR 02	Digital signature invalid. Only digitally signed firmware upgrade files can be installed.
ERROR 03	Wrong firmware version. Downgrade between major versions not possible. Contact NovaTech at <a href="mailto:support@novatechautomation.com">support@novatechautomation.com</a> .
ERROR 04	File name verification failed. Contact NovaTech at <a href="mailto:support@novatechautomation.com">support@novatechautomation.com</a> .

Table 46: Error messages

## Appendix E – Sample Configuration File

```
# kronos series 3 configuration file

# FIRMWARE version
VERSION = 02

# SFP configuration
# MODE A: 4 independent network ports (eth1 ... eth4)
# MODE B: as mode A, but eth1/eth2 are combined into a redundant port
# MODE C: as mode B, but eth3/eth4 also combined into a redundant port
[SFP]
MODE = A

# certificates and keys for SSH, NTS and HTTPS/websockets
[KEYS]
SSH = novatech
NTS = kronos3
HTTPS = kronos3

# IDENTIFIER, LOCATION and CONTACT are shown on the dashboard web page and
# reported as sysName, sysLocation and sysContact when using SNMP
# Replace with values meaningful to the installation
[GENERAL]
IDENTIFIER = Kronos Series 3
LOCATION =
CONTACT =

# Selects what is shown on the unit's dot matrix display
# MODE can be:
# 1: day-of-year (001 to 366) + HH:MM:SS
# 2: HH:MM:SS + STD_NAME/DST_NAME of TIMEZONE
# 3: HH:MM:SS + TIMEZONE OFFSET
# 4: dd mmm HH:MM:SS
# 5: HH:MM:SS + number of satellites used in solution
[DISPLAY]
MODE = 4

# GNSS related settings
# ANT_DELAY is the antenna cable delay compensation in nanoseconds (~4 ns for
each meter of coax cable)
# GALILEO, GLONASS and BEIDOU can be set to True/False in order to
enable/disable the usage of additional constellations
# FORCEGNSS and FORCETIME can be used to simulate antenna connection and GNSS
signal reception
# (use for commissioning work only, set to False before normal operation !)
[GNSS]
ANT_DELAY = 60
GALILEO = False
GLONASS = False
BEIDOU = False
FORCEGNSS = False
FORCETIME = 2024-05-15 12:00

# User defined out-of-bounds limits (in miliseconds)
```

```

# Valid values are from 0.001 (1 microsecond) to 4000 (4 seconds)
[LIMITS]
LOWQUALITY = 0.5
BADTIME    = 1000

# Timezone and daylight saving time rules
# In order to disable DST, specify DST_RULE = NONE
[TIMEZONE]
OFFSET      = 00:00
STD_NAME    = UTC
DST_NAME    = UTC
DST_RULE    = NONE
DST_BEGIN   = M3.5.0/02:00
DST_END     = M10.5.0/03:00

# Settings for the Precise Time Protocol on eth1
[PTP1]
domainNumber          = 0
priority1             = 128
priority2             = 128
logAnnounceInterval  = 0
logSyncInterval       = 0
logMinDelayReqInterval = 0
logMinPdelayReqInterval = 0
announceReceiptTimeout = 2
delay_mechanism       = P2P
hybrid_e2e            = False
network_transport     = L2
udp_ttl               = 1
inhibit_multicast_service = False
unicast_listen         = False
unicast_req_duration  = 3600
dataset_comparison     = ieee1588
G.8275.defaultDS.localPriority = 128
G.8275.portDS.localPriority = 128
power_profile_tlv_enabled = True
grandmaster_id         = 3
transportSpecific      = 0
ptp_dst_mac           = 01:1B:19:00:00:00
p2p_dst_mac           = 01:80:C2:00:00:0E

# Settings for the Precise Time Protocol on eth2
# ignored if SFP_MODE = B or SFP_MODE = C
[PTP2]
domainNumber          = 0
priority1             = 128
priority2             = 128
logAnnounceInterval  = 0
logSyncInterval       = 0
logMinDelayReqInterval = 0
logMinPdelayReqInterval = 0
announceReceiptTimeout = 2
delay_mechanism       = P2P
hybrid_e2e            = False
network_transport     = L2
udp_ttl               = 1
inhibit_multicast_service = False

```

```

unicast_listen          = False
unicast_req_duration   = 3600
dataset_comparison      = ieee1588
G.8275.defaultDS.localPriority = 128
G.8275.portDS.localPriority = 128
power_profile_tlv_enabled = True
grandmaster_id          = 3
transportSpecific        = 0
ptp_dst_mac              = 01:1B:19:00:00:00
p2p_dst_mac              = 01:80:C2:00:00:0E

# Settings for the Precise Time Protocol on eth3
[PTP3]
domainNumber           = 0
priority1               = 128
priority2               = 128
logAnnounceInterval    = 0
logSyncInterval         = 0
logMinDelayReqInterval = 0
logMinPdelayReqInterval= 0
announceReceiptTimeout = 2
delay_mechanism         = P2P
hybrid_e2e              = False
network_transport        = L2
udp_ttl                 = 1
inhibit_multicast_service = False
unicast_listen           = False
unicast_req_duration     = 3600
dataset_comparison        = ieee1588
G.8275.defaultDS.localPriority = 128
G.8275.portDS.localPriority = 128
power_profile_tlv_enabled = True
grandmaster_id          = 3
transportSpecific        = 0
ptp_dst_mac              = 01:1B:19:00:00:00
p2p_dst_mac              = 01:80:C2:00:00:0E

# Settings for the Precise Time Protocol on eth4
# ignored if SFP_MODE = C
[PTP4]
domainNumber           = 0
priority1               = 128
priority2               = 128
logAnnounceInterval    = 0
logSyncInterval         = 0
logMinDelayReqInterval = 0
logMinPdelayReqInterval= 0
announceReceiptTimeout = 2
delay_mechanism         = P2P
hybrid_e2e              = False
network_transport        = L2
udp_ttl                 = 1
inhibit_multicast_service = False
unicast_listen           = False
unicast_req_duration     = 3600
dataset_comparison        = ieee1588
G.8275.defaultDS.localPriority = 128

```

```

G.8275.portDS.localPriority      = 128
power_profile_tlv_enabled       = True
grandmaster_id                  = 3
transportSpecific               = 0
ptp_dst_mac                     = 01:1B:19:00:00:00
p2p_dst_mac                     = 01:80:C2:00:00:0E

[SNMPv1]
RO_COMMUNITY = PUBLIC

[SNMPv2c]
RO_COMMUNITY = PRIVATE
TRAP_COMMUNITY = secret.trap.community
TRAP_HOST1 =
TRAP_HOST2 =

[SNMPv3]
AUTH_NAME = whatever.you.want
AUTH_KEY = very.secret.password
AUTH_PROTOCOL = SHA

# Settings for remote syslog
# Leave TARGET_A and TARGET_B empty to disable remote syslog
[SYSLOG]
LEVEL = NOTICE
TARGET_A =
PORT_A = 514
PROTOCOL_A = UDP
TARGET_B =
PORT_B =
PROTOCOL_B = UDP

[NETWORK]
# CHANGEIP enables/disables changing the IP address of eth0 using the rotary
# knob on the front panel (see user manual for details)
GATEWAY = 192.168.0.254
CHANGEIP = True

[ETH0]
ADDR = 192.168.0.1
MASK = 255.255.0.0
MTU = 1500
NTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH1]
# REDUNDANCY_MODE is ignored if SFP_MODE = A
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1494
REDUNDANCY_MODE = PRP
NTP_ENABLE = False
PTP_ENABLE = False

```

```
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH2]
# Settings for ETH2 are ignored if SFP_MODE = B or C
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1500
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH3]
# REDUNDANCY_MODE is ignored if SFP_MODE = A or B
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1494
REDUNDANCY_MODE = PRP
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

[ETH4]
# Settings for ETH4 are ignored if SFP_MODE = C
# Leave ADDR empty to disable port
ADDR =
MASK =
MTU = 1500
NTP_ENABLE = False
PTP_ENABLE = False
SNMP_ENABLE = False
VLAN_ENABLE = False
VLAN_ID =
VLAN_PRIORITY =

# Signal generation on OUTPUT1 .. OUTPUT6
[OUTPUT1]
# OPTIONS = OFF, IRIG-B120, IRIG-B122, IRIG-B124, IRIG-B126
SIGNAL = IRIG-B124
TIME = LOCAL
POLARITY = NORMAL

[OUTPUT2]
# OPTIONS = OFF, IRIG-B120, IRIG-B122, IRIG-B124, IRIG-B126
SIGNAL = IRIG-B124
TIME = LOCAL
POLARITY = NORMAL
```

```
[OUTPUT3]
# OPTIONS = OFF, IRIG-B000, IRIG-B002, IRIG-B004, IRIG-B006, PPS, PPM
SIGNAL = IRIG-B004
TIME = LOCAL
POLARITY = NORMAL

[OUTPUT4]
# OPTIONS = OFF, IRIG-B000, IRIG-B002, IRIG-B004, IRIG-B006, PPS, PPM
SIGNAL = IRIG-B004
TIME = LOCAL
POLARITY = NORMAL

[OUTPUT5]
# OPTIONS = OFF, IRIG-B000, IRIG-B002, IRIG-B004, IRIG-B006, PPS, PPM
SIGNAL = IRIG-B004
TIME = LOCAL
POLARITY = NORMAL

[OUTPUT6]
# OPTIONS = OFF, IRIG-B000, IRIG-B002, IRIG-B004, IRIG-B006, PPS, PPM
SIGNAL = IRIG-B004
TIME = LOCAL
POLARITY = NORMAL
```

## Appendix F – GPL License Information

Some of the software included in this product contains copyrighted software that is licensed under the GPLv2 and GPLv3 licenses. You may obtain the complete corresponding source code from us by sending a money order or check for \$50 to:

NovaTech, LLC  
GPL Compliance Division  
13555 West 107th Street  
Lenexa, KS 66215

Please write "GPL source for Kronos Series 3" in the memo line of your payment.

This offer is valid to anyone in receipt of this information.

Revision	Date	Changes
A	07/12/2023	Initial release. BM
B	07/27/2023	Updated IRIG-B cabling, PTP, expansion cards 1 and 2, temperature range, SFP RJ45 transceiver, accuracy, support site. BM
C	11/22/2023	Added antenna mounting bracket and surge suppressor information. Updated RG58. Updated port and network settings. Release for shipment. BM
D	01/05/2024	Updated GNSS information. Updated warning icons. BM
E	06/03/2024	Added F75 option. Updated antenna power specification. Added Pctel antenna. Updated GUI. BM
F	10/15/2024	Updates for 02.02.00, updated GUI and configuration file. See release notes on the <a href="#">Support Site</a> . BM
G	02/05/2025	Updates for 02.04.00. See release notes on the <a href="#">Support Site</a> . Power supply voltage 60V dc. Updated error messages. Updated support address. BM