Calnex

Insight and Innovation

Calnex Sentry

The Dedicated Synchronization Monitor

GETTING STARTED GUIDE

Notices

This document refers to Calnex Sentry Software Revision R18.0.0 and higher.
Last Updated: December 2022

Warranty

WARNING

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

To avoid electrical shock:
Use only the power cord supplied, or one with adequate ratings, and connect only to a properly grounded power socket outlet. Ensure the power socket outlet is easily accessible and near the unit.

Do not open covers. Refer servicing to qualified personnel only.

Welcome to the Calnex Sentry Getting Started Guide

This guide provides basic operating instructions for Calnex Sentry hardware, its Graphical User Interface (via VNC), and remote control of the instrument (via API).

The operational guidance herein is designed as a starting point for using Calnex Sentry. Please refer to the appropriate Test Guides and Software Release Notes for detailed operational steps and result interpretation in relation to specific tests.

Contents

Introduction

Calnex Sentry is the all-in-one Synchronization tester for testing and monitoring PTP (IEEE1588v2) and NTP IP/Ethernet networks, and clock signals (including 1 PPS) for data center, financial trading venues, power utility systems, mobile backhaul, and indeed, any network requiring Frequency, Phase or Time Synchronization.

Sentry measures PTP or clock Time Error (TE) for networks that use either ITU-T G.8275.1 Full on Path support, or ITU-T G.8275.2 Assisted Partial Timing Support (APTS)/Partial Timing Support (PTS).

Sentry is designed to simultaneously measure any combination of PTP/NTP, 10MHz, 1 PPS, and user-defined clock signals to multiple industry and standards masks.

Sentry can be configured to have up to two Ethernet inputs (physical channels) with interfaces for rates up to 100GbE. One PTP or NTP stream will be measured on each physical channel. Sentry can also be configured to measure up to 32 additional NTP/PTP streams on the physical channels.

Time Error measurement data is available over an Application Programming Interface (API) for integration into a network management system. Plus, in the event of a loss of GNSS or other reference, the onboard high-stability Rubidium oscillator will continue to monitor network synchronization while in holdover mode.

If Sentry is unable to report results, its internal hardware watchdog resets the instrument and restarts measurements immediately.

Supplied Accessories

After unpacking the Sentry unit, make sure that the accessories below are present. If anything is missing, contact Calnex Solutions by telephone: +44 (0) 1506 671 416 or by email: support@calnexsol.com

- Power cord (1)
- USB Stick (1)
- Getting Started Guide (1)

Specifications

Power Requirements

The unit requires a power source of:
Voltage: 100 – 240Vac
Power: 100W max.
Frequency: 50 – 60Hz

Environmental Data

- For indoor use only

- Temperature: Operating: 0°C to 40°C

- Relative Humidity: Operating: ≤90% non-condensing

- Altitude: Operating: ≤2000m

- Overvoltage category: CAT II

- Safety: EN 61010-1:2010 +A1:2019, CAT II, Pollution degree 2, Measuring category I, CE

- EMC: EN61326-1:2021

Mechanical Data

Dimensions: 438mm x 439mm x 133mm (W x D x H)
Weight: 8.4kg (max)

Platform Specifications

Reference Clock: Built-in Rubidium reference or external reference input 1, 5 or 10MHz
Internal Memory: Sufficient for >3 days measurement

Internal Time Base Stability (hold-over)

Stability Versus Temperature: 20°C to 26°C: $<1\text{x}10^{-11}$ (typ.), -20°C to +65°C: $<1\text{x}10^{-10}$ baseplate
Ageing Rate: $<1\text{x}10^{-12}$ (per day); $<5\text{x}10^{-11}$ (per month); $<5\text{x}10^{-10}$ (yearly)
Warm-up Stability: 12 min to $<1\text{x}10^{-9}$
Allan Variance: $<2\text{x}10^{-11}$ (1s); $<1\text{x}10^{-11}$ (10s); $<2\text{x}10^{-12}$ (100s)

GNSS Disciplining

Built-in GNSS Module: 12 channels, TRAIM GNSS receiver, high sensitivity
Supported Constellations: GPS, GLONASS, Galileo, Beidou and QZSS
Frequency Accuracy: $2\text{x}10^{-12}$ averaged over 24 hours

Safety Instructions

Read this page carefully before you install and use the instrument.

This instrument has been designed and tested according to safety Class 1 requirements of standard IEC/EN 61010-1 and has been supplied in a safe condition. The user of this instrument must have the required knowledge of it. This knowledge can be gained by thoroughly studying this manual.

This instrument is designed to be used by trained personnel only. The cover of the instrument must only be removed for repair by Calnex personnel who are aware of the hazards involved. There are no user-serviceable parts inside the instrument.

If the surface of the Sentry becomes dirty, remove the AC power and clean with a soft lint-free cloth. Never use flammable liquids to clean the device.

Safety Precautions

To ensure the correct and safe operation of this instrument, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this Getting Started Guide.

Use of this instrument in a manner not specified by Calnex may impair the protection provided by the equipment.

In normal operation, the openings in the chassis should not be blocked to allow for the cooling of the internal components.

Always operate this instrument with unrestricted access to the AC power connector.

Warning Statements

WARNING

Shows a potential danger that requires correct procedures or practices to prevent personal injury.

Symbols

Indicates that the user should consult the manual.

Shows where the protective ground terminal is connected inside the instrument. Never remove or loosen this screw.

If in doubt about safety

Whenever you suspect that it is unsafe to use the instrument, you must make it inoperative as follows:

1. Disconnect the mains cable.
2. Clearly mark the instrument to prevent its further operation.
3. Contact Calnex customer service.

For example, the instrument is likely to be unsafe if it is visibly damaged.

Grounding

Whenever an instrument is connected to the mains voltage, any grounding fault will make it potentially dangerous. Before connecting the instrument to the mains supply, you must make sure that the protective ground functions correctly. Only then can the instrument be connected to the mains supply and only by using a three-wire mains cable. No other method of grounding is permitted. Extension cords must always have a protective ground conductor.

A power supply cord is supplied with the instrument. If you obtain a pluggable power cord for use with your local power connection the power cord must meet all local safety requirements, have an integrated safety ground wire, and be rated for the power requirements of the Sentry.

WARNING

If the instrument is moved from a cold to a warm environment, condensation may cause a shock hazard. Ensure that the grounding requirements are strictly met.

Never interrupt the grounding cable. Any interruption of the protective ground connection inside or outside the instrument or disconnection of the protective ground terminal is likely to make the instrument dangerous.

Power Switch

This instrument is equipped with a secondary power switch. It disconnects the main power-consuming circuits on the secondary side of the power supply. Mains voltage is always present on the primary side.

WARNING

Always consider the instrument active as soon as it is connected to the primary AC power source with a mains cable. Disconnection of the mains cable completely cuts off the power supply to the instrument.

Disposal of Hazardous Material

This instrument uses a 3V lithium cell to power a Real Time Clock. It is placed in a holder and can be replaced by qualified personnel who are aware of the hazards involved.

WARNING

Disposal of lithium cells requires special attention. Do not expose them to heat or to excessive pressure, which may cause the cells to explode. Make sure they are recycled according to local regulations.

GNSS Antenna Installation

This instrument is equipped with GNSS receiver which requires GNSS antenna input. This input should be connected properly and safely to the external GNSS antenna.

⚠️ **WARNING**

For permanent installation, the GNSS antenna and associated cables require an EMP Protector to be fitted for safety reasons. The EMP Protector should be professionally fitted as per the manufacturer's instructions. These instructions come with the EMP Protector.

Observe all local regulations on the fitting, grounding and specification of lightning or surge arrestors on the antenna cable.

Disconnect or switch off in-line equipment when installing, checking, disconnecting and connecting EMP protectors. This includes also the exchange of gas discharge tubes. Keep back from such activities during thunderstorms. Be aware that only a complete protection system according to IEC 62305-1 can protect your instrument and personnel against the impact of lightning.

This includes an external lightning protection system with air terminal, down conductor and grounding system and bonding of all incoming and outgoing lines (e.g. protectors for mains, data and telephone lines) – not RF lines only.

With gas discharge tube protectors take care that the GDT has been properly installed before putting the instrument into operation.

Front Panel Description
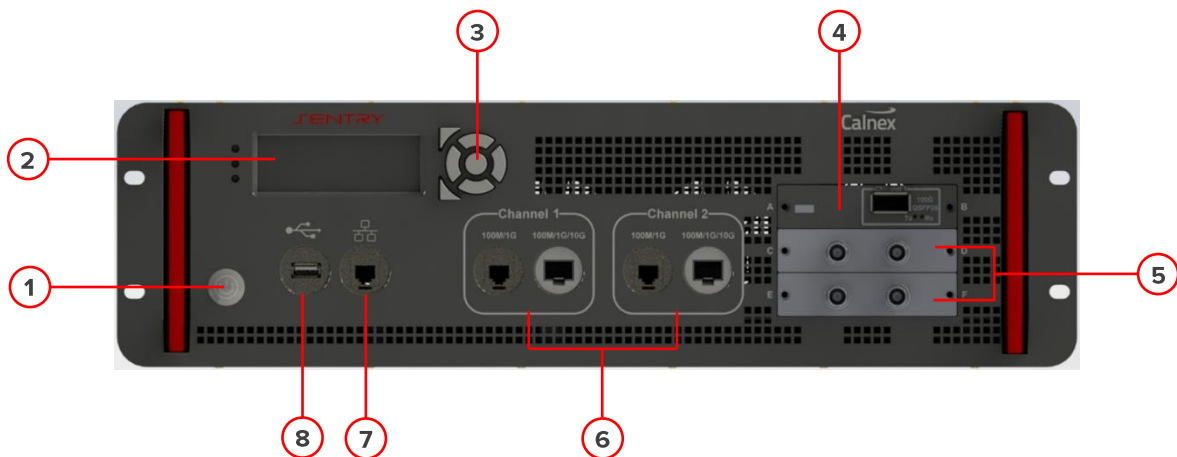
1. On/Off Switch

Press this button to switch Sentry On or Off. Switch off at the front panel before switching off the AC input on the rear panel.

To shut Sentry down, press this switch once followed by the Select control button. If for any reason the instrument does not shut down using this method, hold the shutdown button for approximately 10 seconds until the instrument powers down.

2. LCD Status Display

This displays the instrument's current IP address, state, and the time remaining for any measurements taking place.

3. Status Display Control Buttons

These are used to interact with the status display. Usable buttons are the Select (center circle) button and the directional arrow (up/down/left/right) buttons.

4. 100G QSFP28 Ethernet Port Module[1]

This is for connections to 100G interfaces on Ethernet devices. The pluggable interface supported is QSFP28 (100G).

5. Unbalanced Clock Frequency Measurement Module[1]

This is for connection to BNC unbalanced clock frequency measurement channels. 2 channels per module.

- Frequency: 1 PPS/2s to 200MHz
- Impedance: 75Ω or 1MΩ selectable.
- Voltage Range: -5V to +5V
- Sensitivity: 60mmVpp
- Signal Type: Symmetrical pulse (Clock signal), Unsymmetrical repetitive pulse (Clock signal), HDB3-coded data (Data signal), AMI B8ZS, B3ZS (Data signal)

6. 100M/1G RJ45 Electrical Ethernet and 100M/1G/10G SFP(+) Optical Ethernet Measurement Ports

These are for measurement Channel 1 and 2 connections to 100M/1G electrical interfaces (RJ45) or 100M/1G/10G (SFP(+)) optical interfaces on Ethernet devices, where licensed.

7. LAN

This is for connection to the network or directly to a PC/laptop. The connection to the control port (RJ45) is 1GbE.

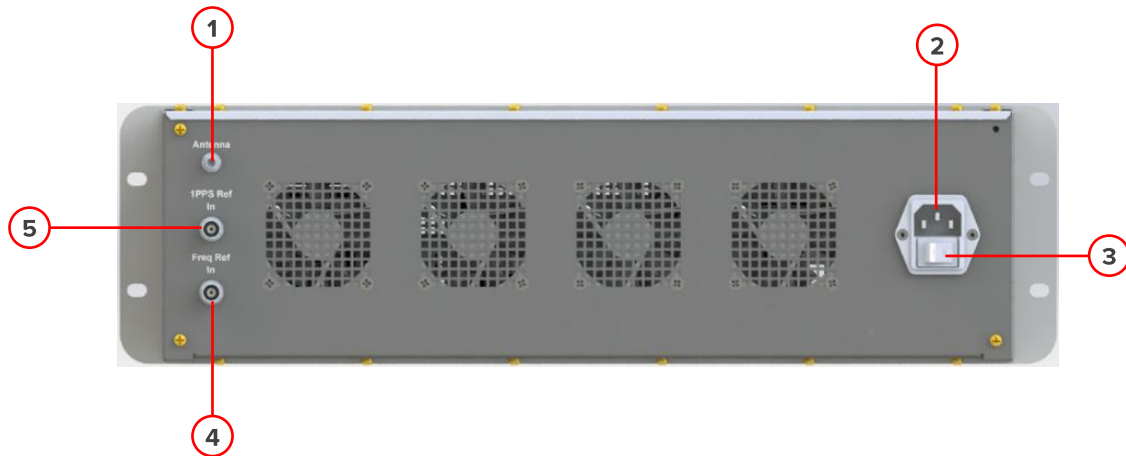[1]100G and clock modules are an optional configuration for Sentry.

8. USB

This is for storing measurement results and configuration presets, and performing firmware upgrades via a memory stick and can also be used to power any USB accessories.

Connector: USB type A

Max supply current: 400mA

USB version: 2.0

Rear Panel Description

1. GPS Antenna Input

SMA connector for direct connection to an external GPS Antenna.

2. AC Power Input

For connection to supplied AC power use the power cord supplied, or one with adequate ratings. For details of power requirements refer to the earlier 'Power Requirements' section on Page 4.

3. AC Power Switch

Use this switch to turn the Sentry AC Input On or Off.

4. Frequency Reference In

Input for precision external reference (1, 5, or 10MHz clock).

5. 1 PPS Reference In

Input for external 1 PPS phase reference (TTL/50Ω).

Connecting Sentry to the Network

Switch Sentry On

To use Sentry, connect it to a suitable power source, switch the AC Power Switch to the **On** position and press the **On/Off** button on the front panel. You will be presented with a message on the Status Display to indicate Sentry is initializing:
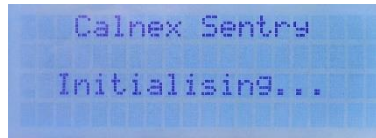

Sentry boots up with the previously configured network settings, including IP mode (DHCP/Static), IP address, subnet mask, and default gateway.

The default shipping configuration for Sentry is static IP mode with an IP address of 192.168.0.100. Most users will need to either configure Sentry to obtain an address from a DHCP server on the network, or modify the default static IP address so that Sentry is visible on the LAN.

## Configuring Sentry for DHCP Mode

To configure Sentry to obtain an IP address from a DHCP server, you must press and hold the **Up** directional arrow button whilst switching the instrument on. The Status Display indicates DHCP mode is now active and, when initialization is complete, Sentry will attempt to obtain an IP address:
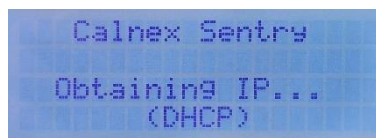
If successful, the IP address is shown on the Status Display – this address can be used for VNC access to the GUI and/or API remote control. If Sentry cannot obtain an IP address, the Status Display will read ***No network***.

Configuring Sentry for Static IP Mode

To configure Sentry to use a specified static IP address, you must press and hold the **Down** directional arrow button whilst switching the instrument on. The Status Display indicates Static IP mode is now active:
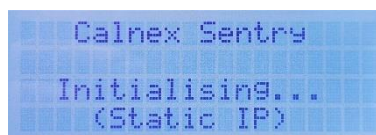
Sentry will then use the last Static IP address configured. If no Static IP address has been configured, Sentry will use the default IP address (192.168.0.100).

Changing Sentry's Static IP

To change the default static IP address to a user-selected one, you must set up a connection directly between a computer and Sentry's LAN port. The computer's IP address should be configured to be within the same subnet range as Sentry. In the example below, the computer's IP address is set to 192.168.0.50. This process should only be attempted by network administrators or knowledgeable users.

This example is for Windows 10; please consult your operating system's guide or network administrator for all other operating systems.

1. Ensure the controlling computer is connected via Ethernet cable to the LAN Port on the front of the Sentry.
2. Open the **Windows Control Panel** on the controlling computer and ensure the view is set to **Category View**.
3. Select **View network status and tasks** under the **Network and Internet** section.
4. On the left menu, select **Change adapter settings**.
5. Right-click on the network adapter that the Sentry is connected to (if unsure which is the correct adapter, please consult your system administrator). Select the **Properties** option.

6. The **Ethernet Properties** window should open.

7. Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.

8. The **Internet Protocol Version 4 (TCP/IPv4)** window will open.

9. Select the **Use the following IP address** field.

10. In the following fields enter:

    - IP Address = 192.168.0.50

    - Subnet Mask = 255.255.255.0

    - Leave Default Gateway empty
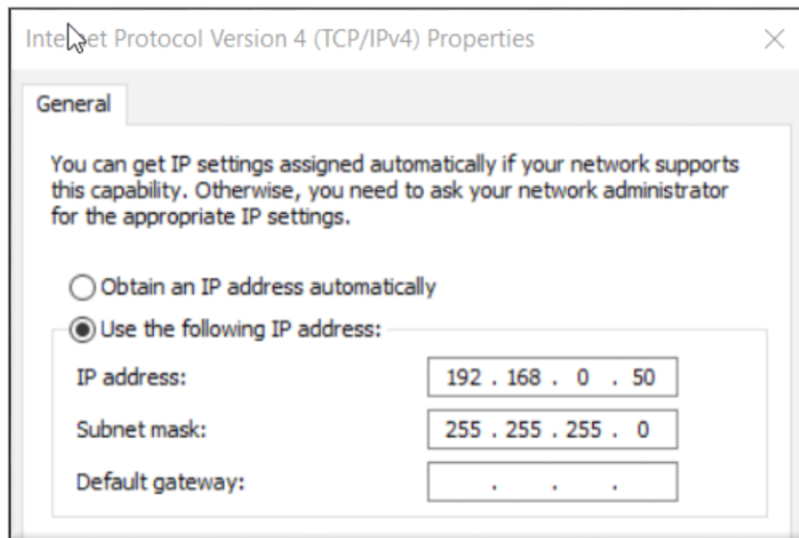
11. Select **OK** and exit. The **Ethernet Properties** window should open.

12. Your computer will now be assigned a static IP address of 192.168.0.50.

13. If Windows reports any problems please contact your system administrator.

14. Verify that your computer can "see" the Sentry by opening a command prompt and entering:

    `ping 192.168.0.100`

    If the Sentry does not reply to ping, please contact your system administrator.

Once a connection has been established between the computer and Sentry, the static IP address can be changed via the GUI, accessible through VNC, as outlined below.

1. Download and install VNC client software (e.g. UltraVNC, VNC Viewer). Once installed, enter Sentry's IP address into the **"Connect to"** field. This should display the Sentry start-up screen.

2. Select **Manual Setup** to access the main operating screen.

3. From the configuration bar at the top of the screen, click the **System** tab.

4. On the System page, click **Network and Sharing**.

5. On the Ethernet page, select either the **IPv4** or **IPv6** tab (depending on the IP version used) then the **Manual** roundel. From this page, you can specify the **IP address**, **Subnet mask** and **Default gateway** for Sentry's LAN port.
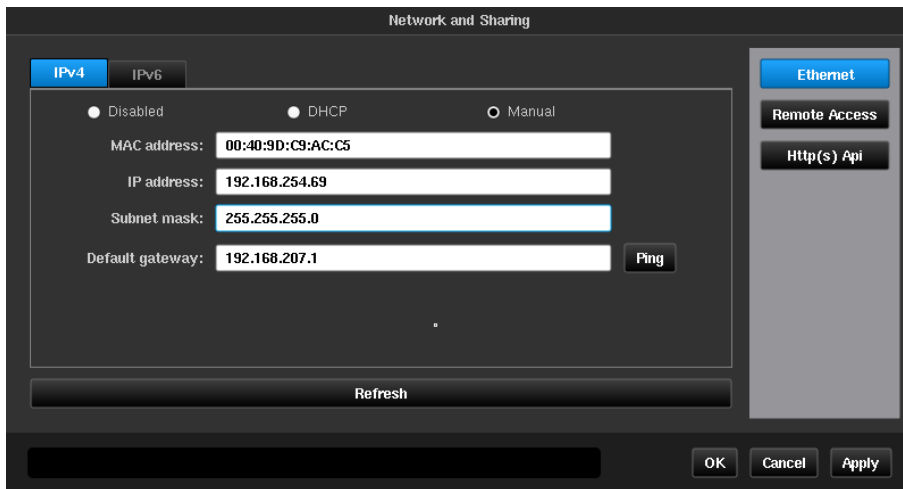
6. Click **Apply** to apply any changes made to this page or **OK** to apply changes and return to the **Settings** page.

   The Status Display will update to display the new static IP address and the computer will no longer be able to access Sentry.

User Interface Basics

To connect to the Calnex Sentry and access its GUI, enter the IP address shown on the front panel Status Display into your VNC client. Once power-up is complete, a screen is displayed with the option to **Recall Settings** from a previously saved configuration file or enter **Manual Setup** to manually configure the instrument. Selecting the Manual Setup option moves directly to the main operating screen, as seen below:

1. Configuration Bar

Each of the tabs in the configuration bar allows for user configuration of Sentry.

- **Presets** – Automatically set Sentry's configuration to match a previously saved preset file, save the current configuration as a preset file, or set Sentry back to the default configuration.

- **Mode** – Select which measurement inputs should be active (e.g. clock, PTP, NTP and SyncE).

- **Settings** – Configure the measurement parameters (e.g. duration, sample time, references used), check GNSS status, and set the configuration of each of the active measurement channels (e.g. clock signal type, Ethernet rate and profile to be used).

- **Masks** – Set one or more limits on measurement metrics, based on pre-defined standards.

- **Health Check** – Automatically detect and configure the signal for clock inputs, check that Sentry's PTP protocol is working as expected for the PTP profile being used, and perform a debug packet capture on the Ethernet interface(s).

- **Data** – Recall data from a previous measurement, or export the most recent measurement in .csv format.

- **System** – Set the instrument's date/time, change the LCD brightness, configure the LAN port, enable/disable remote access, manage the internal and/or external storage, view installed options, view event log, update the firmware, export problem report, reboot the instrument, or clear all data.

2. Measurement Graph Window

Displays the result of the selected metric for the current measurement, along with any applied masks. Graphs auto-scale to fit the current data or enabled masks.

3. Measurement Configuration Details

Provides information on the measurement parameters for the current measurement, as configured on the **Settings** > **Measurement** page.

4. Status Line

Provides information on the current measurement status of Sentry, including the time remaining when a measurement is running.

5. Viewing Mode Selector

Select which information to display in the center of the main operating screen – full-size graph window , measurement analysis (mean, last, max and min values) , or masks table . When measurement analysis or masks table is selected, the graph window size will be reduced to accommodate.

6. Start/Stop Measurement Button

When Sentry is idle, this button starts the measurement using the current configuration and prompts you to select a location to save the data.

When a measurement is running, this button stops the measurement, processes and saves the data, and provides a pass/fail indicator based on any applied masks. A short report is generated on measurement completion.

7. Graph/Metric Selector

Select which graph or metric is displayed on the measurement graph window for the current measurement and select which graphs and metrics are selectable from the main operating screen.

8. Channel Widget Panel

Each measurement channel is represented by a widget on the widget panel. Widgets show (where appropriate for the given input) signal type, line rate, IP address, whether the signal is present (clock), whether the appropriate messages are present (PTP/NTP), whether the measurement is within the applied mask(s), information on the physical properties of the input (signal voltage, SFP information, etc.) and quick access to the channel configuration page.

The color beside the channel name/number in the widget panel matches the measurement result color on the measurement graph window for easy identification.

9. Status Icon Indicator

Shows the current status of Sentry's references and battery, represented as colored icons. The icons shown in the image above are for the timebase reference, Rubidium, Rubidium disciplining, GNSS, power, and battery statuses.

Clicking on this section of the screen opens a page that gives a detailed description of each icon and its possible states.

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