NTS-pico

Miniature NTP Time Server for Small Networks

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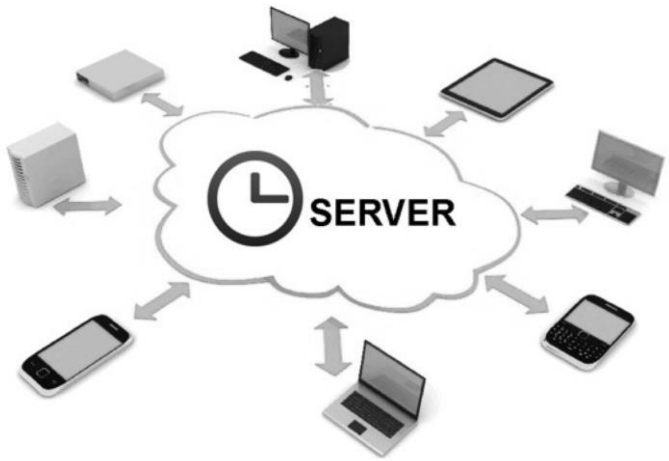
Introduction

Safety instructions

Except external power supply (230VAC), this equipment contains DC (3-12VDC) voltages. Do not handle any metallic part until the 230VAC power supply has been disconnected! Do not assemble, disassemble set when the power reminds switched ON. Making wiring and touching cables is strongly prohibited when power is ON. Never work alone under hazardous voltage conditions. Always check that the power cord(s), plug(s), and sockets are in good conditions. Always use qualified service personnel to install permanently wired equipment and surge antenna arrestors.

What is NTS-pico?

NTS-pico is a complete, stand-alone, miniature NTP Time Server. Optionally it supports PTP too. It works in Ethernet TCP/IP environment. It has been designed to provide a stable **UTC** (Coordinated Universal Time) synchronization, which possesses the long-term stability of **GNSS (Global Navigation Satellite System**) to small industrial local networks up to 10 PC. The standard synchronization accuracy is level of hundreds of millisecond [ms] for LAN and it is sub-tens of second [s] for Internet. Therefore, **NTS-pico** is not time instrument and should not be use at scientific, laboratory or advanced IT synchronization environments.



NTS-pico id dedicated for up 10 pcs networks

The NTS-pico GNSS receiver is designed for automatic operation without the need for user intervention. It can however, be accessed via a serial port (rs232 or USB) for configuration and debug purposes. If the satellite signal is interrupted, the NTS-pico enters a FREE RUN mode. NTS-pico is not including internal OSC and therefore it is not supporting HOLDOVER mode. When the GNSS signal is restored, the GNSS receiver automatically reverts to normal operation mode. For this reason, it is important to continuously trace the performance of GNSS signals and synchronization process. Following synchronization Ethernet protocols are supported:

- **NTP Network Time Protocol (rfc5905)**
- **SNTP Simple NTP (rfc 4330)**
- **PTP Precision Time Protocol IEEE1588:2008 /extra option/**

Referential UTC is drawn from GPS & Glonass via built-in Telit GNSS receiver, using NMEA183 frame. NTS-pico does not support 1PPS frequency reference.

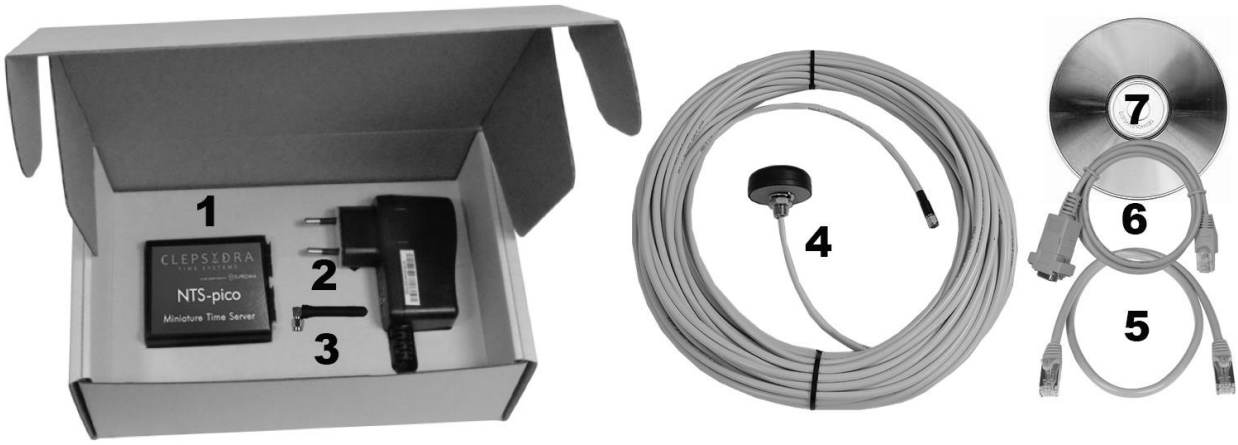
Installation

Hardware

The NTS-pico box on arrive includes:

1. NTS-pico miniature time server (pcs 1)
2. Power supply 12VDC/230VAC (pcs 1)
3. Indoor GSM antenna (pcs 1)
4. Outdoor active GPS antenna w/ 30m coax H-155 and accessories (pcs 1)

Options (not included in standard set):
5. Ethernet cable 1m RJ45/RJ45 (pcs 1)
6. RS232 cable 1m DB-9/RJ45 (pcs 1)
7. CD with PDF manual (pcs 1)



NTS-pico set

Note! Set does not include antenna mast, but antenna can be mounted directly using attached accessories: claps, bracket, nuts etc. - they are included.

General presentation

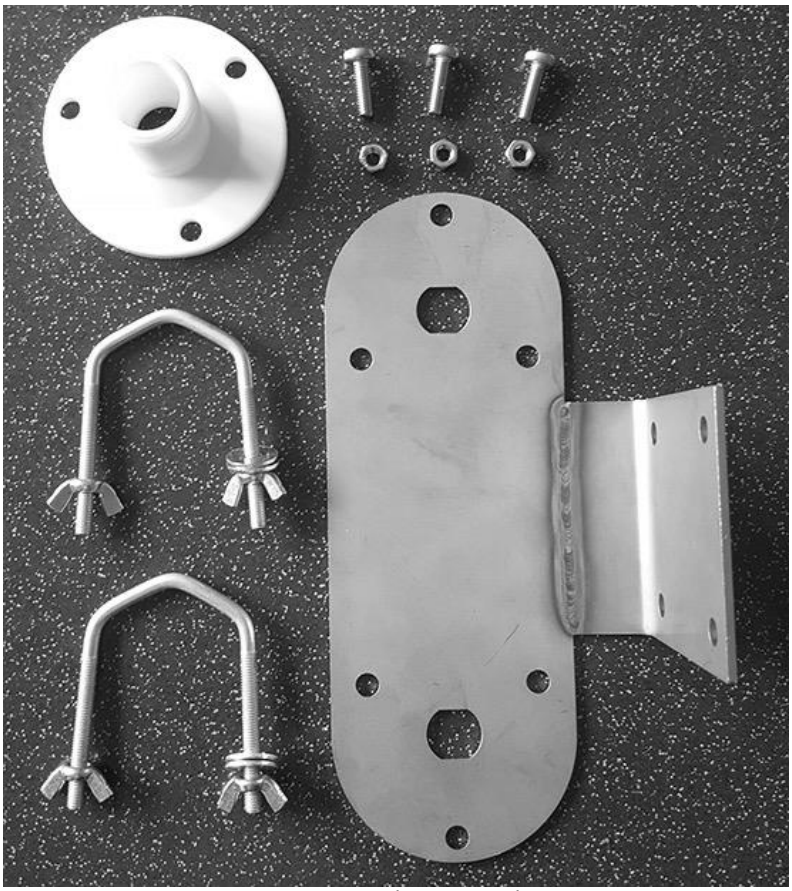
NTS-pico includes:

- **1x GPS (SMA)**
- **1x Pwr (VDC)**
- **1x LAN (RJ45)**
- **1x RS232 (RJ45)**
- **1x USB**
- **1x GSM (SMA)**
- **1x SIM socket**

NTS-picture view

Special version of NTS-pico can include extra:

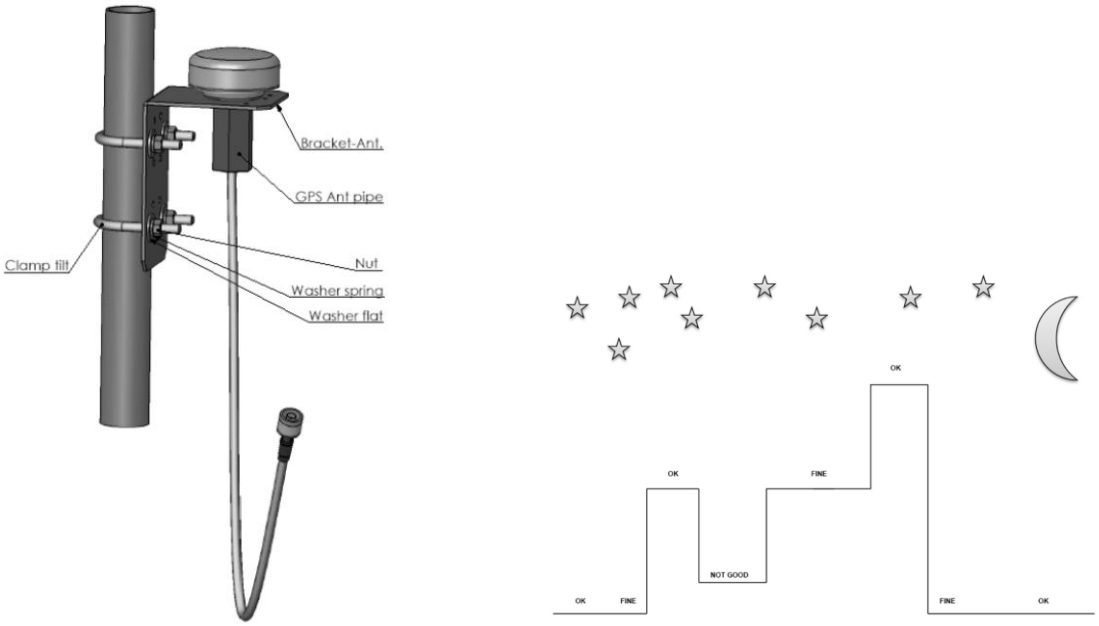
- **1x Wi-Fi(SMA)**
- **1x SIM socket #2**
- **1x CAN-bus I/O**



antenna mounting accessories

Antenna Mounting

Installing a basic system will require the following (a) **mounting of the antenna** (b) optionally **mounting 1 or 2 lightning arrestors** (not included to product set). The antenna supplied is of the active type, and is suitable for almost all applications. It is supplied with a pre-attached, 30-meter H-155 coax cable, terminated with a male SMA connector. Before commencing installation, check that all the items detailed in the contents list have been supplied. The antenna is supplied with mounting clamps for attachment to a mounting pole, included too. Mast antenna suspension (H=0.5m) is not included but it is available as separate products from Elproma. Following figure shows an example of how mounting antenna might be achieved.



Mounting GNSS antenna

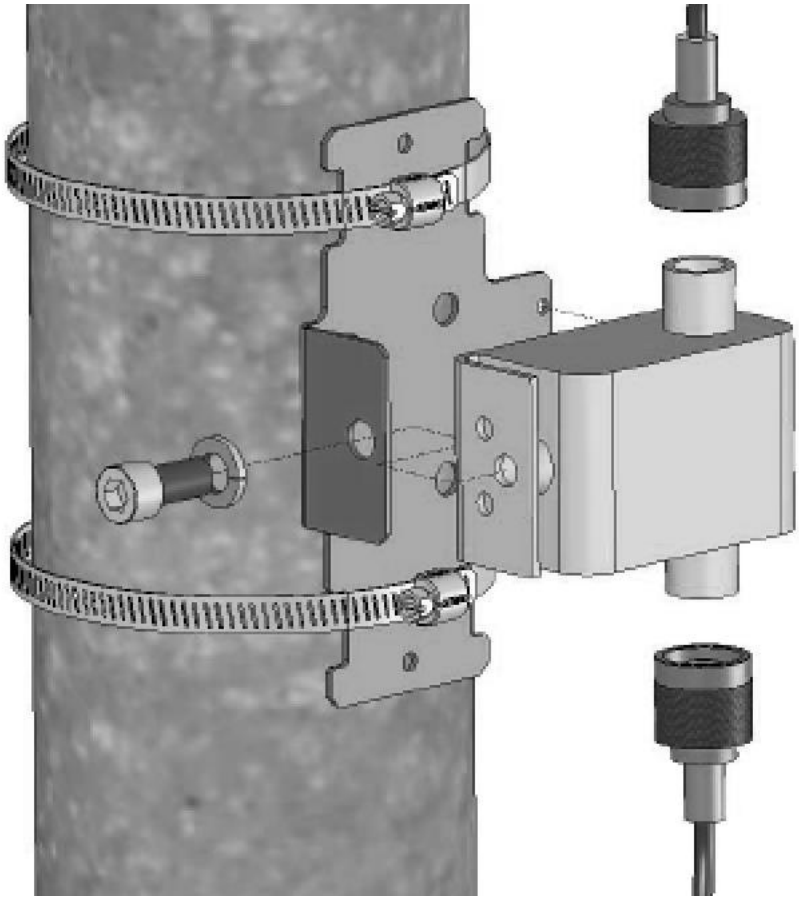
Note! *The most important consideration in selecting a position for the antenna is the presence of objects which obscure the sky or horizon. Where possible, there should be no obstruction to a full view of the sky.*

Overhead wires and other very narrow obstructions may be considered as invisible to the signals, provided that they are a few meters away. Large flat surfaces can decrease performance of the receiver. Be especially wary about mounting the antenna directly onto the fascia of a flat roof. To overcome this situation, elevate the pole about 1 meter above the flat surface. A satellite prediction mobile phone program may usefully be employed to check a potential installation, and also to identify directions in which obstructions may be a particular source of problems.

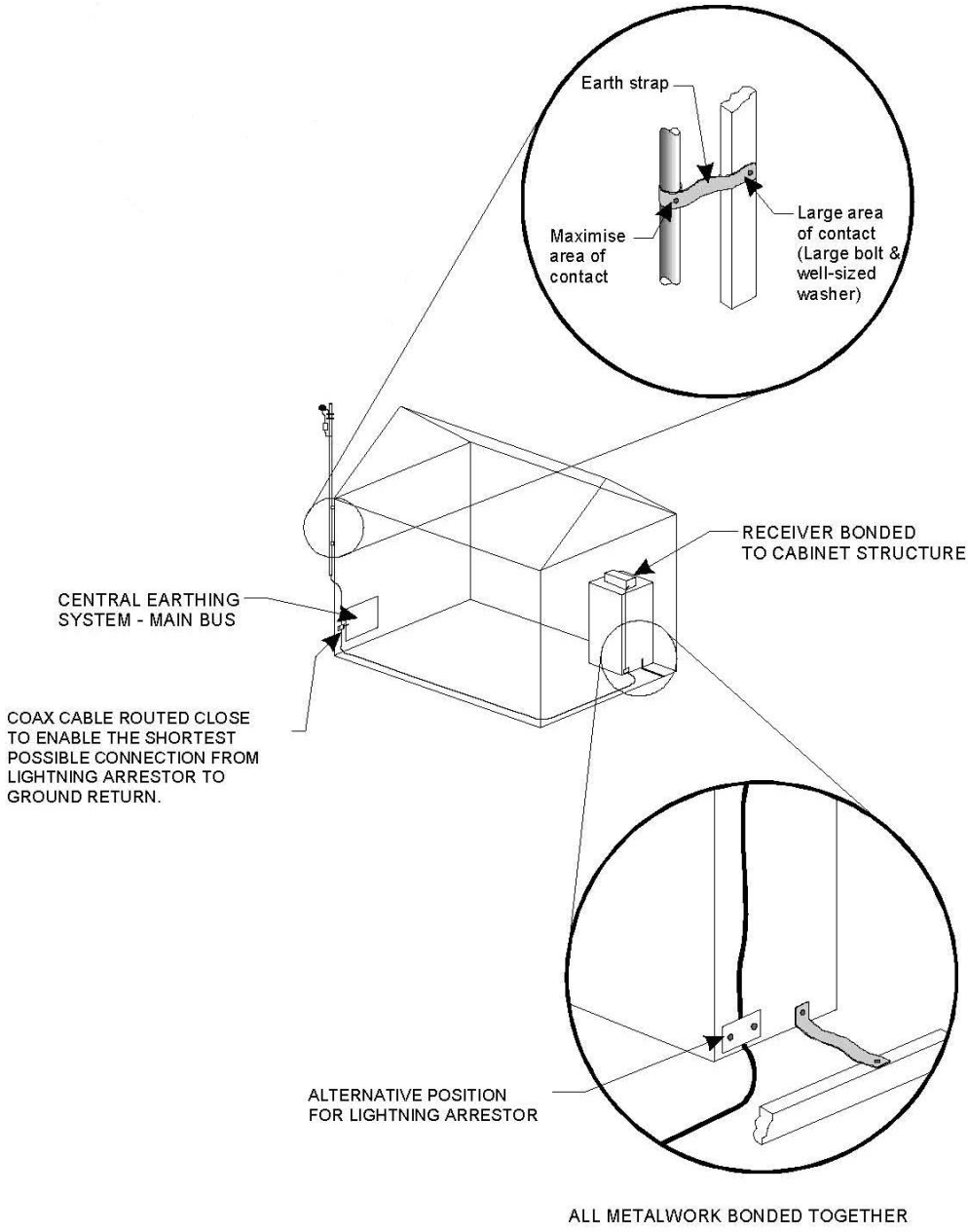
Note! *When the NTS-pico is operational, the GNSS antenna assembly may be disconnected for short periods (e.g. maintenance or repair) without interruption to the unit synchronization LAN output.*

Additional lightning protection considerations

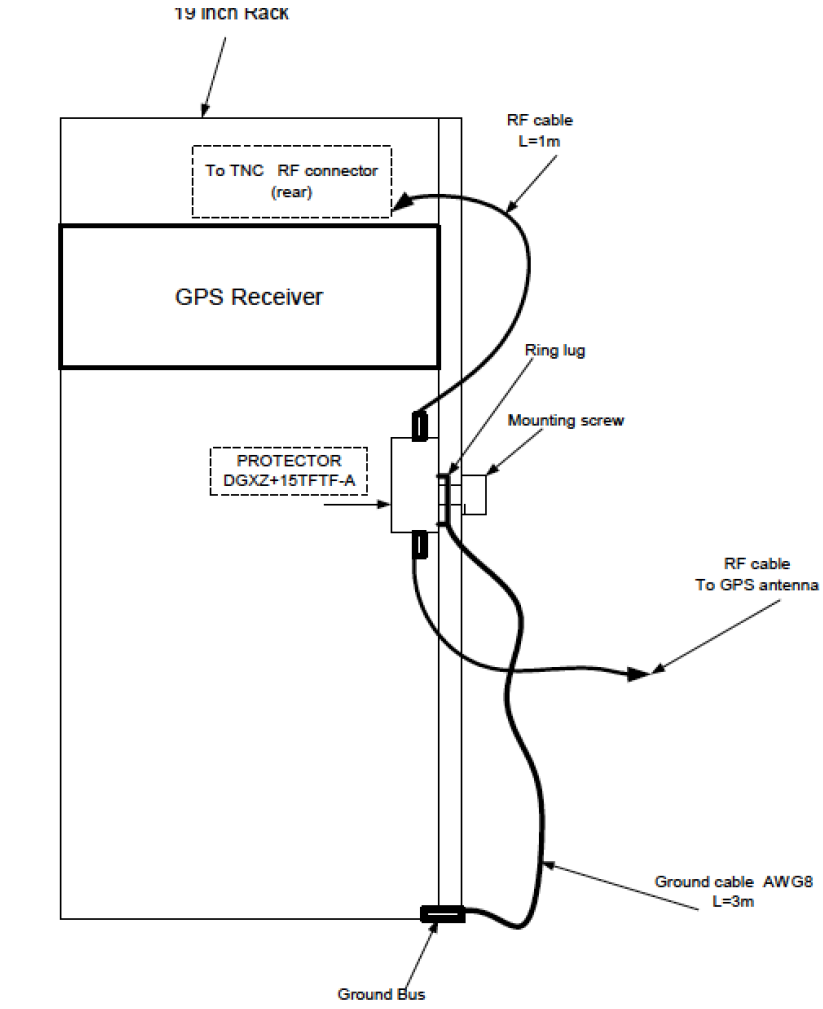
As the antenna is roof mounted (to have a clear view of the sky) it is likely to be exposed to lightning strikes.

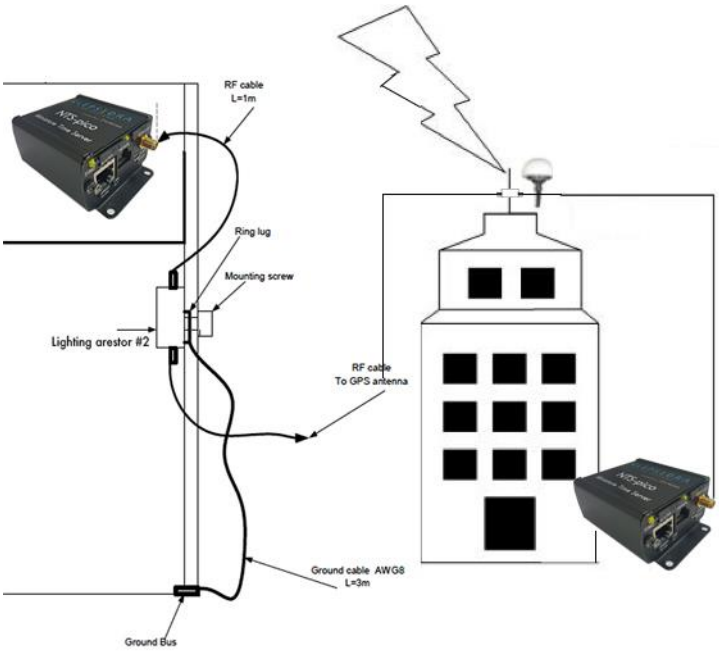


Protection against this is afforded by ensuring adequate grounding of the mountings as described below. There is no way to provide 100% protection for electronic equipment from direct strike damage. It is possible however, to reduce the likelihood of damage from near strike induced fields by ensuring the installation obeys some fundamental rules. A proprietary lightning arrestor should be installed, of a type which does not reduce GNSS signal transfer. Install the lightning arrestor near to the antenna (e.g. on the mounting pole), ensuring all connections maintain electrical and environmental protection. After taking the precautions described previously in the antenna installation, it should be understood that a destructive residual current may still be present in the cable coming down from the antenna to the NTS-pico unit. A second lightning arrestor should be installed near to the NTS-pico to further dissipate any remaining lightning energy. At the earth end please use multiple connection points if at all possible. All connections should incorporate as large an area of contact as possible. This may be achieved by using large bolts, and washers of substantial diameter. All connections should incorporate as large an area of contact as possible, which is made more probable by the use of large bolts, and substantial washers. Where there is no access to the metal framework of the building, it is absolutely imperative to erect a suitable lightning conductor. Failure to do so is almost certain to result in destruction of NTS-pico and connected into it equipment in the event of the antenna receiving a near lightning strike.



Grounding system





NTS-pico surge protection

Powering up

1. Connect GNSS antenna to SMA connector at NTS-pico
2. Connect Ethernet LAN cable to RJ45 connector
3. Plug-in DC power supply to power input and turn power ON

Basic SETUP

Go to your web browser and put IP address 192.168.1.234/255.255.255.0.
You will be asked for username and password. By defaults are:

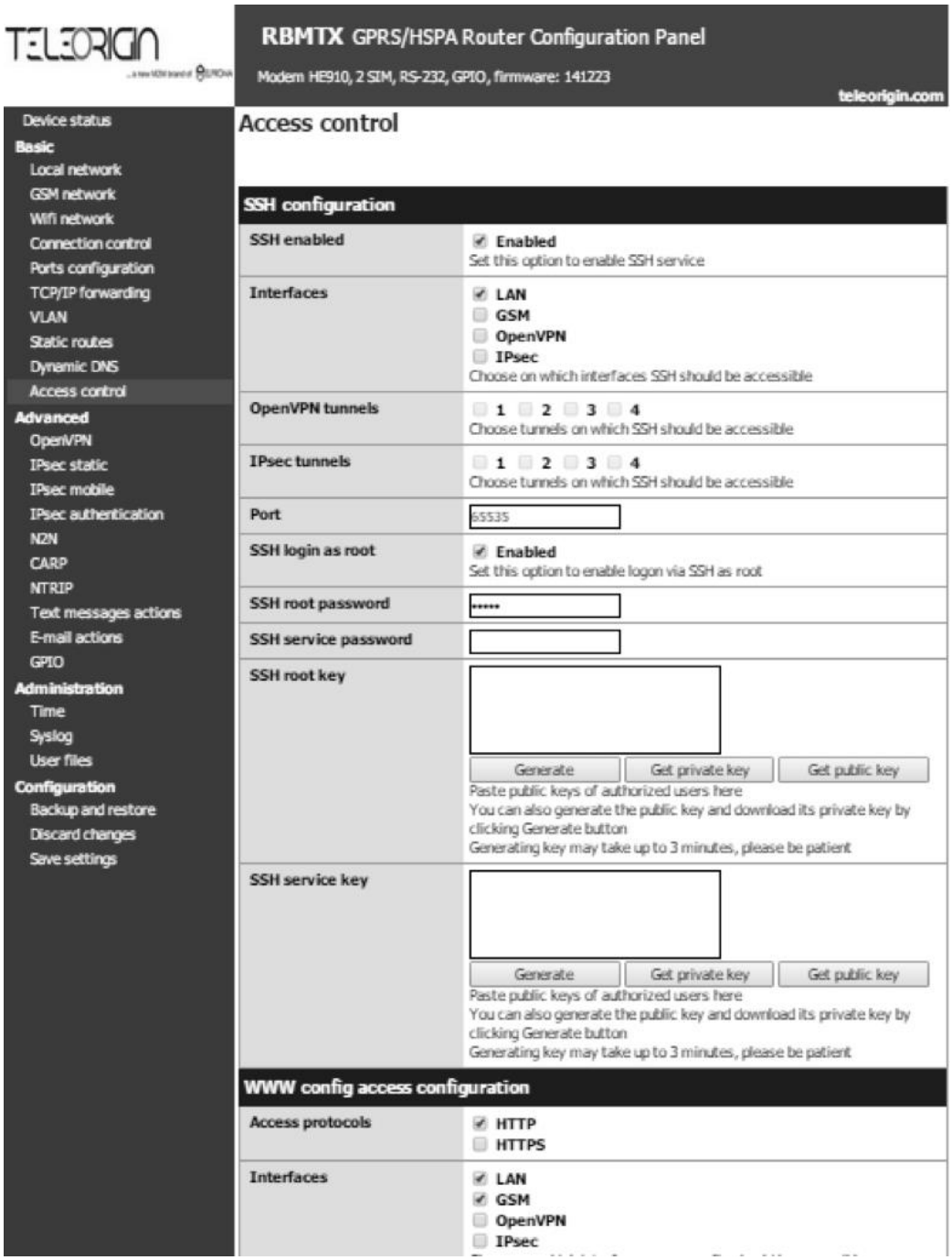
Username: ***admin***
Password: ***12345***

IP addressing

Minimum configuration requires setup IPv4

On LAN configuration page you can find essential parameters needed for LAN connection. Here you can set IPv4 address, mask, default gateway.

IMPORTANT NOTE!
For time synchronization purpose please do not use DHCP/DNS.
You will need to keep SSH communication ON for GNSS signals tracing.

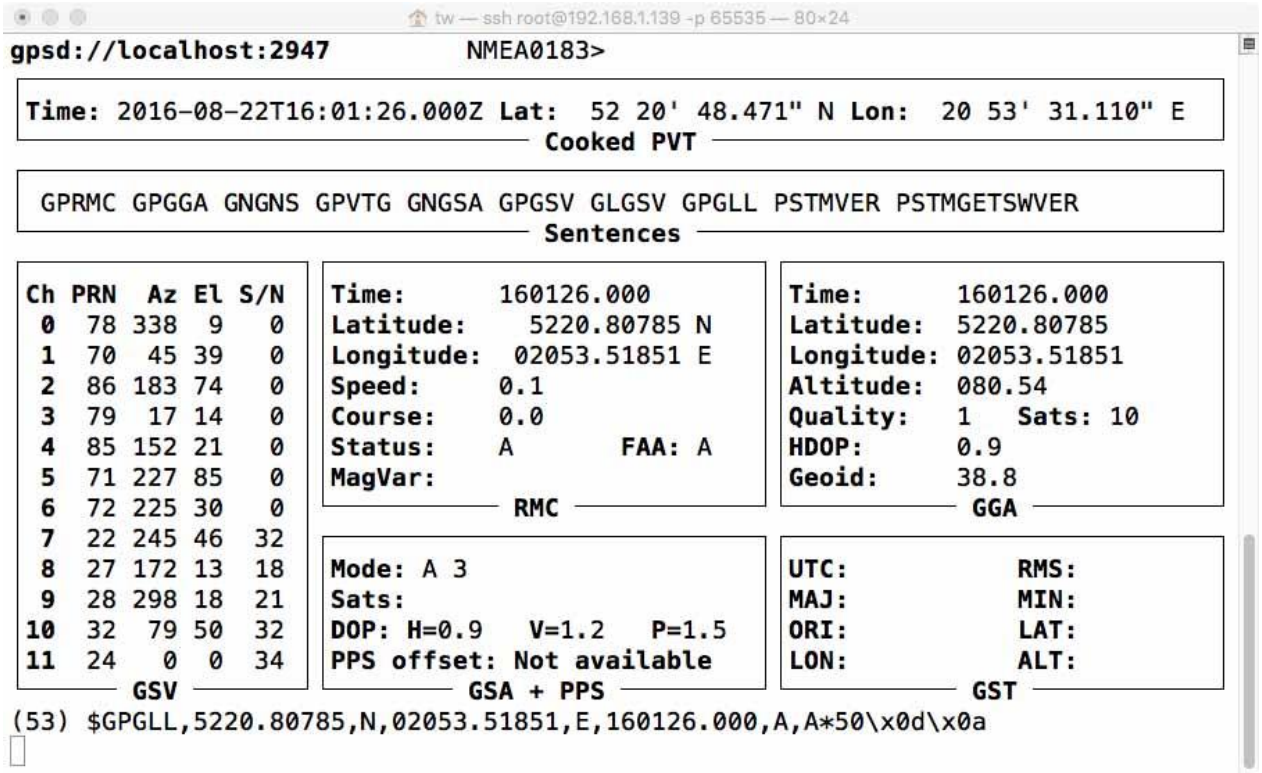


SSH enable (ON) and password is necessary for tracing on-line GNSS signals

Monitoring GNSS satellite signals ON-LINE

You SSH communication must be switched on first. Please execute from window terminal following commands:

```
ssh root@192.168.1.234 -p 65535
root@192.168.1.139's password: 12345
[root@rbmtx ~]# TERM=vt220
[root@rbmtx ~]# gpsmon
```



GPSmon tool let you trace satellite signals on-line

This screen is the tool to monitor GNSS (GPS & Glonass) satellite signal performance. You should be able to receive signals from at least not less than 4 satellites. Well done installation mostly let view 10-20 GNSS satellites in view. It takes approx. 5-10 minutes since power on to get minimum #sats in view.

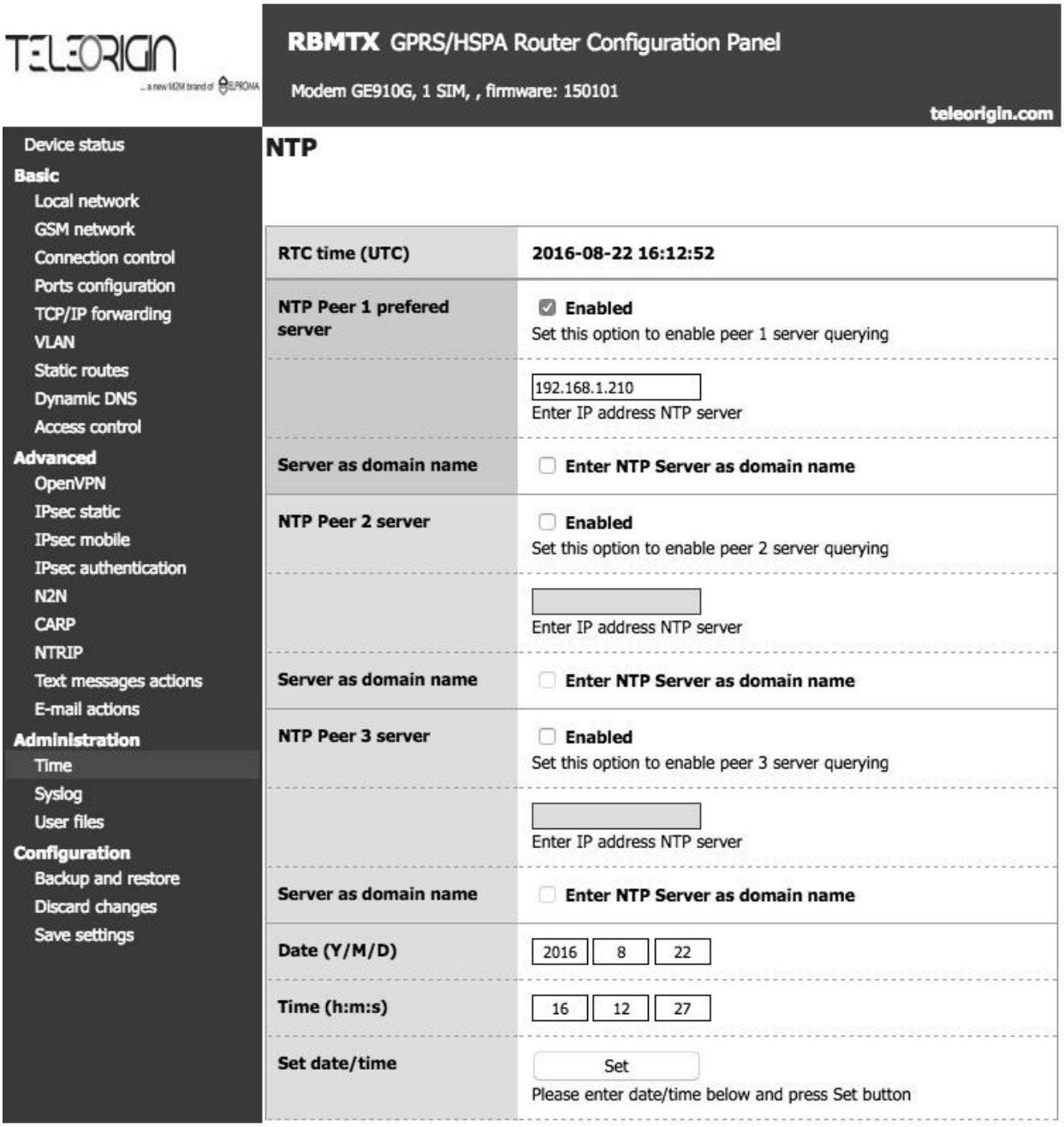
Recommendation!

For Linux/Unix and Mac OSX please use BASH std. terminal.
For Microsoft Windows there are various of 3rd party SSH software suppliers. One of the most popular one is free available *putty.exe*

Running NTP (Network Time Protocol)

Configuring NTP

To start operate NTS-pico as NTP server, just simple run web setup again, and select in ***Time*** menu option ***NTP Peer 1 preferred server*** to be set (ON). In addition, please provide any random (not used by any other device) IPv4 address that corresponds to NTS-pico IP class of IPv4 address. Please note, NTS-pico requires to fill this IPv4 data field in to start acting NTP server. Once all is done you are ready to use NTS-pico Time Server with NTP.



Monitoring NTP on-line

You SSH communication must be switched on first. Please execute from window terminal following commands:

```
ssh root@192.168.1.234 -p 65535
root@192.168.1.139's password: 12345
[root@rbmtx ~]# ntpq
```

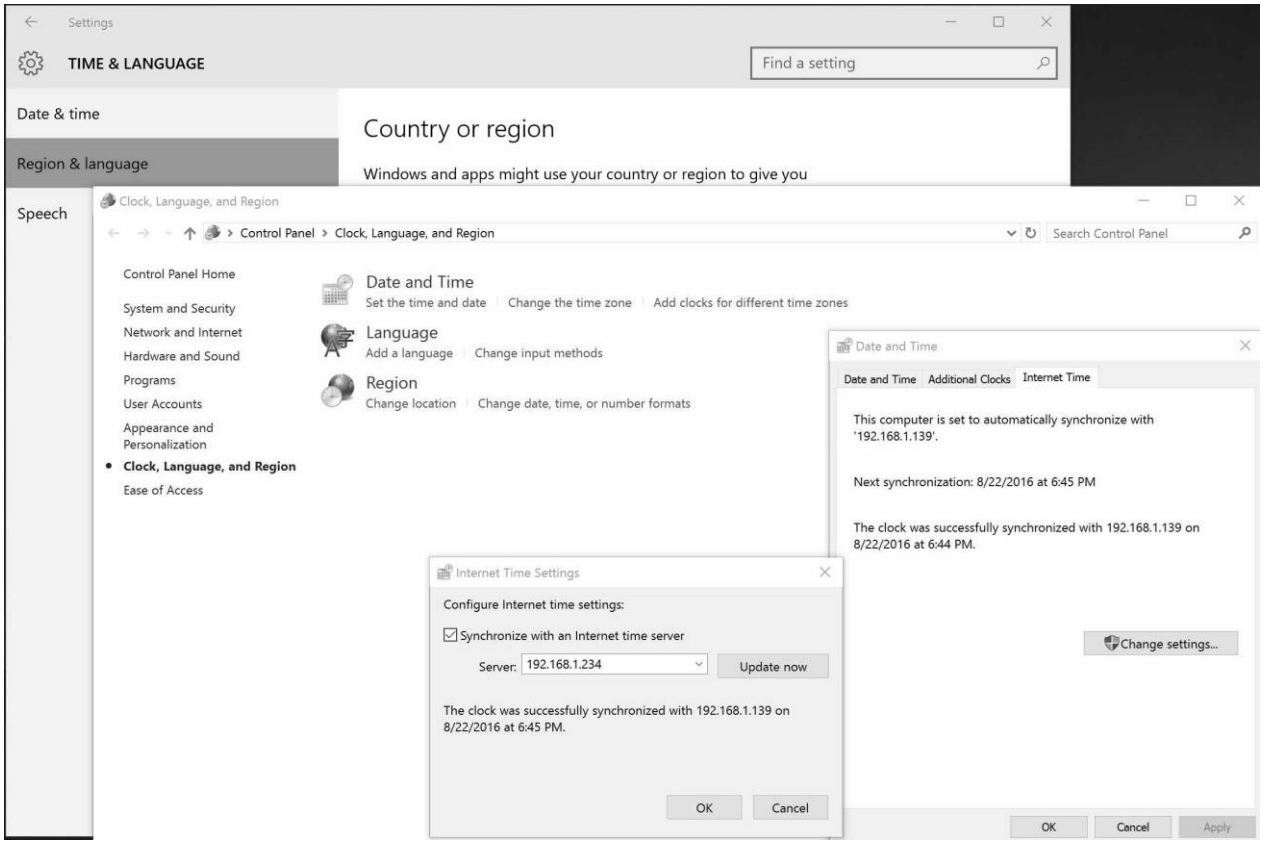
You can use full spectrum of std. NTP monitoring tools incl. ***ntpq*** and ***ntpdc*** to trace and monitor Network Time Protocol. For more information please ref. to www.ntp.org

```
[root@rbmtx ~]# ntpq
ntpq> pe
     remote           refid      st t when poll reach   delay   offset  jitter
==============================================================================
*SHM(0)          .GPS.            0 l    2   16  377    0.000  -13.592  10.463
x192.168.1.210   .RB.             1 u    1   16  377    0.502   81.484   0.412
ntpq> rv
associd=0 status=0415 leap_none, sync_uhf_radio, 1 event, clock_sync,
version="ntpd 4.2.6p5@1.2349 Wed Sep 23 09:10:39 UTC 2015 (1)",
processor="armv5tejl", system="Linux/3.14.17", leap=00, stratum=1,
precision=-18, rootdelay=0.000, rootdisp=14.556, refid=GPS,
reftime=db65a60c.739613f4  Mon, Aug 22 2016 16:25:48.451,
clock=db65a610.3da81e00  Mon, Aug 22 2016 16:25:52.240, peer=19830, tc=4,
mintc=3, offset=-13.592, frequency=-8.817, sys_jitter=0.000,
clk_jitter=4.472, clk_wander=0.091
ntpq>
```

ntpq debugging tool for NTP

Synchronizing Microsoft Windows clcok

You simply synchronize any version of Microsoft Windows by simple selecting “Time from Internet” and providing NTP-pico IPv4 . Below there is example for Windows 10.



Using NTS-pico as primary source of NTP time for Microsoft Windows

Synchronizing Linux & Mac OSX clock

Both Linux and OSX included built-in NTP protocol. You can simple manually modify ntp.conf file by providing your NTS-pico IPv4 address, however we recommend to use similar Microsoft Windows high level OS Time & Date operations.

Running PTP (Precision Time Protocol)

PTP settings:

- PTP Enabled

Enables PTP grandmaster daemon

- PTP options:
    - Transport layer
        - L2 (Ethernet): PTP packets are encapsulated directly in Ethernet frames (IEEE 802.3 network transport)
        - L4 (UDP): PTP packets are exchanged over UDP/IPv4
    - IP mode

The option available for L4 (UDP) transport layer only.

        - multicast (default)
        - unicast
        - hybrid mode

Multicast for SYNC and announce packets, unicast for delay request and response packets.

    - Delay mechanizm
        - E2E (default)

Delay is measured end-to-end. Delay is calculated for the whole path: grandmaster/master/boundary clock - transparent clocks - slave ordinary clock (GM/MC/BC - TC - OC/SC).

        - P2P

Delay is measured peer-to-peer. If transparent clocks are present in a network they need to support peer-delay mechanizm (and be configured to enable it).

    - SYNC interval (default 1)

SYNC packet interval value must be in range -7....7 (recommended limits are -3...3).

        - -4: 62.5ms (1/16 s)
        - -3: 125ms (1/8 s)
        - -2: 250ms (1/4 s)
        - -1: 0.5s (1/2 s)
        - 0: 1 second (typical interval)
        - 1: 2 seconds (default)
        - 2: 4 seconds
        - 3: 8 seconds
        - 4: 16 seconds

RBMTX GPRS/HSPA Router Configuration Panel

Modem LE910, 1 SIM, , firmware: 170718

teleorigin.com

- Device status
- **Basic**
  - Wan config
  - Local network
  - GSM network
  - Connection control
  - Ports configuration
  - TCP/IP forwarding
  - VLAN
  - Static routes
  - Dynamic DNS
  - Access control
- **Advanced**
  - OpenVPN
  - IPsec static
  - IPsec authentication
  - NTRIP
  - E-mail actions
  - PTP
- **Administration**
  - Time
  - Syslog
  - User files
- **Configuration**
  - Backup and restore
  - Discard changes
  - Save settings

PTP settings

PTP	☑ **Enabled** Set this option to enable PTP service.
PTP options	
Transport layer	L2 (Ethernet) ▼
IP mode	multicast ▼
Delay mechanism	E2E ▼
SYNC interval	1 You can change sync interval here

APPENDIX

Technical Specification

GNSS Antenna

Electrical properties	
Frequency	1575.42 MHz
Impedance	50 Ohm
V.S.W.R	<2.0 Max
Gain	38 dB
Power supply	3-5VDC (10 mA)
Noise fig.	<1.5 dB Typ.
Polarisation	RHC (Right Hand Circular)

Mechanical properties	
Dimensions	H=120mm (∅=10mm)
Antenna type	Active Marine GPS
Cable cover	black
Antenna cable	30m H-155