

GPS NTP TIME SERVER

Rack Version V2



Description:

- Server is dedicated to synchronize network devices local time/date to Universal Time (UTC)
- Devices synchronizing own local time through the NTP V3 protocol. (Network Time Protocol)
- Time Server is joined to atomic cesium etalon nist.datum.com over the GPS satellite system.
- The main Time Server two processor electronics are placed in to the Rack 19" case / 1U, suitable to mount in to the server room.
- GPS receiver and antenna are mounted outdoor waterproof case IP-65.
- Connection between external GPS receiver and server is realized through the standard TP twisted pair cable up to 200m.

System Topology:

Time server consist as two components:
Main Time Server rack case and IP65 water proof external GPS receiver with active antenna.



Technical specifications

- **Ethernet:** 10 Base T, RJ 45 connector
10 MBit
RX polarity: automatic

ICMP: implemented
Gateway: implemented, user configurable
DHCP: not allowed
MAC address: configurable
Ethernet mask: configurable

 - **GPS** External receiver with active antenna
Powered from server
Output protocol: ZODIAC Connexant
Baudrate: 9600Bps
PPS pulse: 1sec
Cable:
 - 1 twisted pair for zodiac data
 - 1 twisted pair for PPS pulse
 - 2 wire for power
Power: 9..12V DC
Current consumption: 300mA
max cable length: 200m

 - **NTP protocol:** Built in NTP/SNTP v3 unicast server/client - SNTP v4 broadcast on request only
security keys: not implemented
NTP Time stamp resolution: 13usec

 - **Time Accuracy** **In UTC FIX state**
max error: 300 nsec / 1sec
 - due to built in NTP time stamp resolution 13 µsec
 - device network accuracy = 13 µsec
Without GPS UTC FIX state:
max error: +/- 2ppm approx: 5sec/month
in temperature range: 0..40°C

 - **SNMP protocol** Built in SNMP traps,
server produce and send SNMP traps to dedicated Ethernet Device,
 - on every changes the number of satellites,
 - UTC fix changes
 - GPS receiver failures

 - **Main processor** RISC UBICOM IP2022
120 MHz / for Ethernet connectivity 10BaseT

 - **GPS processor** Microchip RISC processor
20 Mhz
for GPS messages, PPS pulses, LCD ,buttons serving

 - **RTC** Real Time Clock
PHILIPS I2C,
powered from lithium CELL CR2430, User Replaceable
TCXO Thermal compensated quartz.
Max Error: +/- 2ppm
-

<ul style="list-style-type: none"> Reliability: Two processors watchdog-ing state every 1sec <ul style="list-style-type: none"> - BOR Brown Out Reset - POR power on reset - two internal watchdog independent watchdog timers
<ul style="list-style-type: none"> Security User password to setup IP address, SNMP strings- community name...
<ul style="list-style-type: none"> WEB interface Built in WEB server for dynamic CGI WEB pages <ul style="list-style-type: none"> - monitoring server status - setup time server - 4MBit dataflash
<ul style="list-style-type: none"> Temperature ranges -25 .. 55 'C
<ul style="list-style-type: none"> Power: 100 .. 250 V AC / 50Hz
<ul style="list-style-type: none"> Display LCD 2x 16 chars Green BackLight
<ul style="list-style-type: none"> Buttons 4x buttons on front panel <ul style="list-style-type: none"> - SET,ESC,UP,DN for setup IP addresses
<ul style="list-style-type: none"> Server Case 19" rack / 1U Depth: 110mm

Front Panel

Buttons:

On the front panel are mounted 4 buttons:

SET: for enter to current menu

UP, DN buttons to change menus and increment / decrement input values

ESC: to cancel current input value

PPS and FIX LED

Green PPS LED flashing in 1sec period. LED is connected directly to signal PPS from receiver. If PPS LED not flashing GPS receiver is not connected, in this case server is malfunction, and displayed will be message <PPS ERROR>

FIX LED must lighten continuously in UTC fix state, otherwise flashing.

■ Configuration

To change the current value of IP address, network mask, pressing the up/dn button choose appropriate value and by **SET** button it is possible to change current value.

Before value changes user will be asked to password. Set the password holding UP/DN button and confirm by **SET**.

Current password for the LCD Display is "013".

Only after the correct password was entered, user can change values.

Correct password is keeping in system in 5 minutes and next inputs in this time not required the password.

After the entering value LCD processor write data to internal EPROM and sends to Ethernet processor with message:

Send to IP2K

■ MAC Address

MAC consists of 6 bytes, but only 4 last bytes is possible to edit. Most significant 2-bytes are: 000, 003

■ LCD Messages

<**PPS Error**> message reported with beep failures on PPS signal from GPS receiver. In this case check the cable to GPS receiver, check the fuse 500mA, mounted on back panel.

Note: without the PPS signal server is in the malfunction state.

<**GPS DATA Error**> message indicate the mismatch or missing the DATA from receiver. Check cable and fuse described as PPS error.

<**Send Setup Fail**>

on power on reset state, LCD processor sends the current setup to Ethernet IP2K processor.

If the Ethernet processor not confirmed the values, this error message will be occurred.

BACK PANEL



■ FUSES:

Mounted are two fuses:

GPS receiver fuse: 500mA/T to make protection the GPS power sources.

Time server fuse: 500 mA/T to protection all power sources

■ APP Connector

Application connector DSUB15 Female for additional purposes.

PPS signal output, RS485 timecode format 0 output 9600,N,8,1

■ GPS connector

DSUB9 Female to connect the external GPS receiver. See the below picture for wiring external receiver.

■ Ethernet connector

10BaseT RJ45 connector for ethernet connectivity. We note that to HUB or switch are needed NOT crossed cable.

For single PC CROSSED calbe.

■ Back panel LEDs

Red indicate Ethernet link activity, must be lightening on successful connectivity.

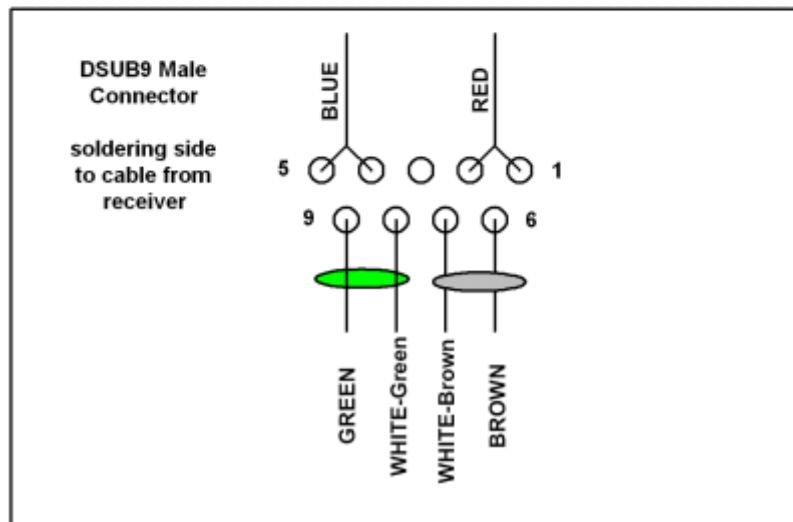
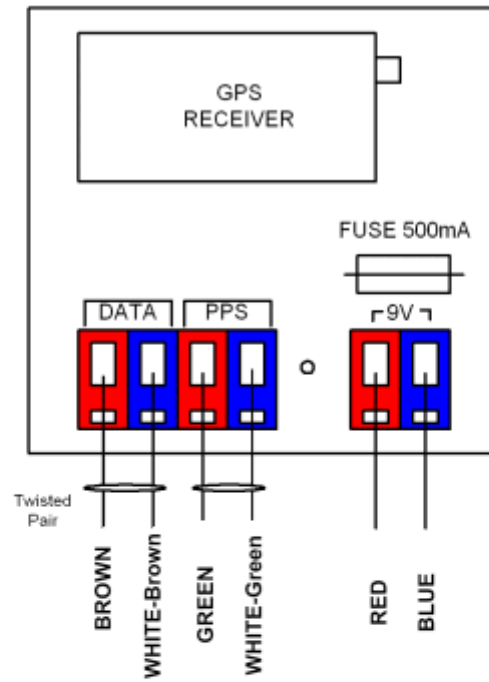
Green LED blinking in 1sec interval, it mean reception datagram from LCD processor.

External GPS receiver



- Time Server is delivered with water proof IP 65 wall mounting external receiver and built in GPS active antenna.
- Mounted **JUPITER TU35-D410**
- Operating temperatures: -45 .. 85°C
- Receiver is powered from Time Server.
12V DC / 300 mA through the Fuse 500mA on TimeServer Back Panel and FUSE 500mA/T on receiver daughter board also. See green box on board.
- Connection to server with twisted pair TP cable.
1 pair for DATA
1 pair for PPS signal
+ 2wire DC power
- max cable length: 200m
- It is strongly recommended to use standard TP cable for ethernet networks. It is low cost and good solution.
- On gps receiver board are mounted low impedance RS485 line drivers
- In the Time server are mounted 100 Ohm resistors on both lines: DATA, PPS, to minimize glitches and noise.
- GPS DATA baudrate: 9600b/sec
- Receiver output protocol: ZODIAC Connexant

External receiver wiring



WEB Server Implementation

- In the Time Server is built in the **WEB server** for monitoring the status, setup network...
- All HTML, source files are located in 4MBit dataflash
- Its possible to replace source files by user by TFTP protocol.

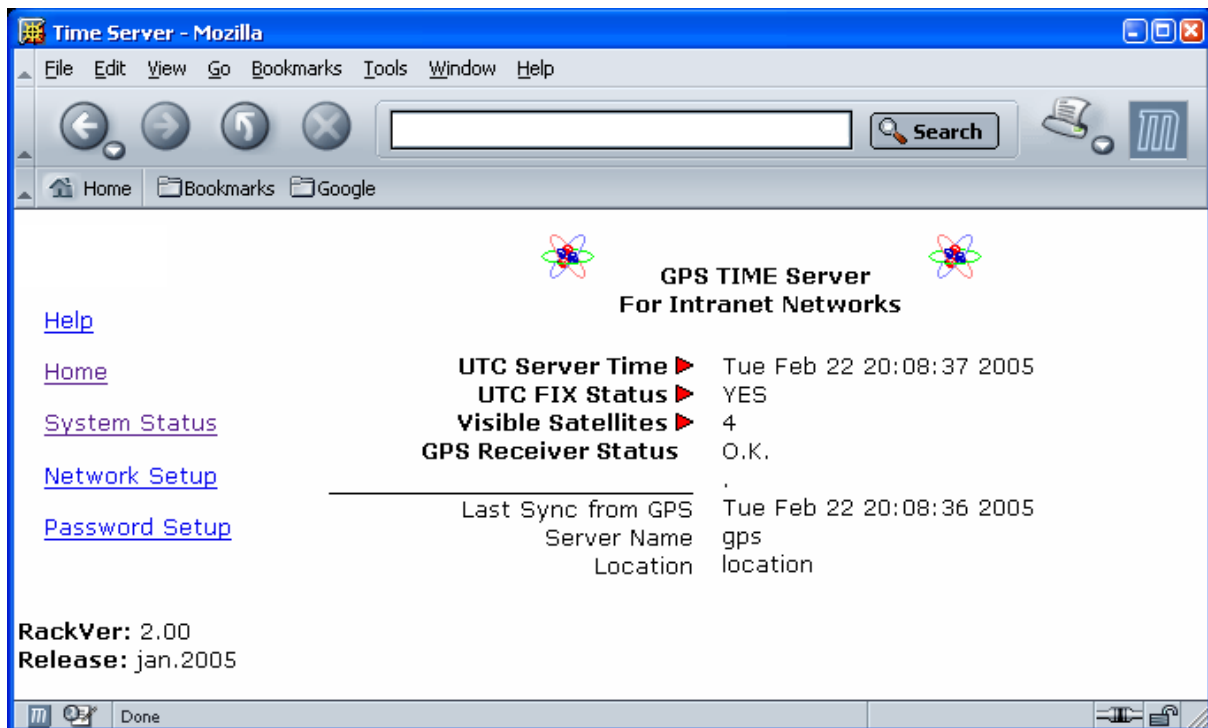
Main Page --- index.html ---

to open main page of Time Server simply open your browser and into the address line write:

<http://110.0.0.135>

Note: 110.0.0.135 is example here, because it is the default IP Address, you need the real IP Address

Browser will request the time server and it respond the main page:



UTC server Time:

Current UTC time. To obtain new values press **reload** browser button.

UTC FIX Status:

This information is loaded from the GPS receiver. In the NOT FIX state time Server closes the NTP protocol.

Visible satellites:

Indicate the total number of satellites from which are measurements making.

GPS Receiver Status:

Describes the status of GPS receiver, available messages are:

O.K.

PPS Error Signal of PPS pulse missing, in this state check the cable from reciever

DATA Error Serial data from receiver missing, check the cable also

Fatal Error GPS receiver is not connected, or malfunction , check the FUSE on back panel

Server Name

indicate the user replaceable Time Server Name. Name is used for SNMP traps.

Server Location

Describes the Time Server Location also for SNMP traps implementation

System Status

**GPS TIME Server
For Intranet Networks**

Server system Status

Up Timer from last Boot [sec]	344
PPS length in internal ticks	77067
RTC Offset [usec]	257356
Number of Lost UTC Fix	0
<hr/>	
Num of NTP packets received	11
Num of NTP packets rejected	0
<hr/>	
Heap free system memory	1271
SNMP strings checksum status	O.K.

PPS Length

Describes the length of the PPS pulse from GPS receiver. Value is rated in internal counter with period 13usec.
PPS length must be approx 77000 ticks, num of ticks depends from the mounted processor quartz.
Strongly in constant length in every second.
Otherwise time server close the NTP protocol to 100 secs.
It mean that on cable from GPS receiver was some glitches.

RTC offset [usec]

Up Time from last boot:

indicate the elapsed time in seconds from last boot.

PPS Length

Length of the PPS pulse from GPS receiver. Value is rated in internal counter ticks with period 13usec.
PPS length must be approx 77000 counts.

Value must be strongly in constant length in every second.

Otherwise time server closes the NTP protocol to 100 secs.

Its mean that on cable from GPS receiver was some glitches detected.

Number of Lost UTC FIX

Indicate the total number of GPS UTC time FIX lost from last boot.
If the GPS receiver has no fix utc, server close the NTP protocol.

Num of NTP packet Received

Total number of NTP packets received from any host.

Num of NTP packet Rejected

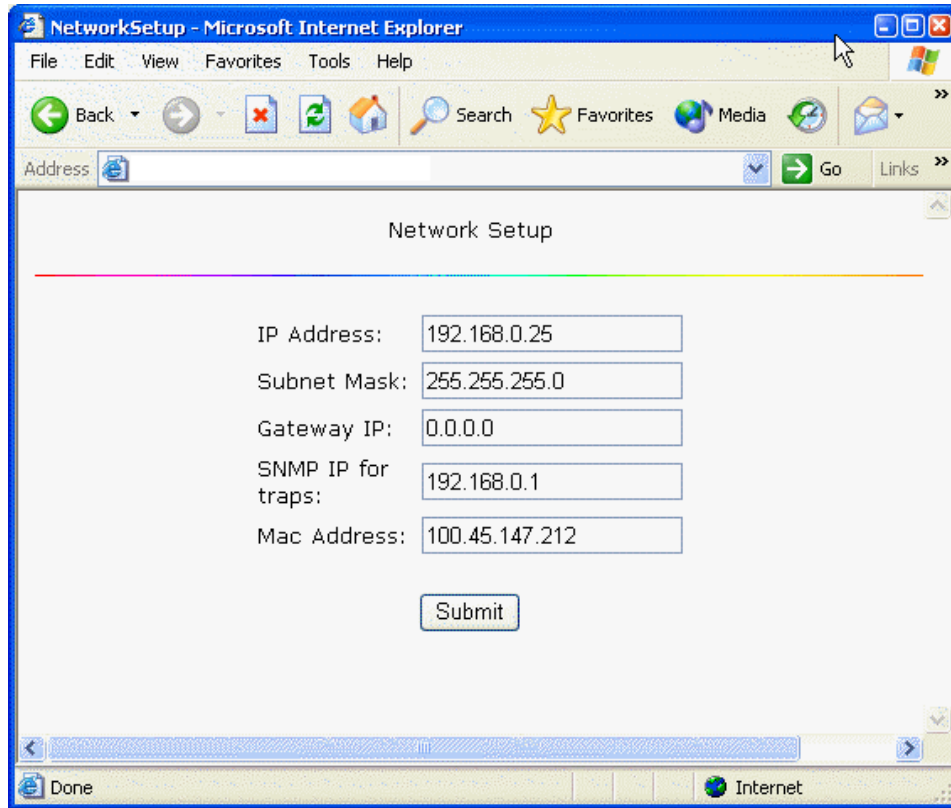
Total number of NTP packet rejected.

NTP request packet from any host will be rejected on occurrences:

- the UTC FIX state is failure – UTC NOT FIX status
- server detected the glitches on PPS signal, after the glitch time server close the NTP ramp to 100 seconds.

Network Setup HTML Page

To Network setup page user will be navigate after the enter the correct password (Default="123456").



Network Setup

IP Address:

Subnet Mask:

Gateway IP:

SNMP IP for traps:

Mac Address:

- Current time server values will be filled into the textboxes.
- Enter the 0.0.0.0 to Gateway textbox if the gateway is not used
- MAC address consists of last 4 bytes , first bytes are: 000, 003 in this example MAC = 0.3.100.45.147.212
- After the <Submit> Time Server Reboot, it is needed to connect to Time Server with new values.
- All values will be written to the DataFlash memory and to LCD processor EEPROM also

SNMP TRAP description

Time server produce SNMP trap messages on every changes of internal status, where status byte is represented as 8-bit value:

Status Byte:

Bit	Description
7	Not used
6	1 = PPS pulse from GPS receiver present 0 = PPS pulse missing / this is fatal error , GPS receiver is not connected
5	1 = GPS data message present 0 = GPS Data missing , Fatal error, GPS receiver is not connected or Zodiac Data Message cable error
4	1 = UTC FIX status OK 0 = UTC FIX status error, in this state is NTP ramp closed and every NTP requirement from host will be rejected
3..0	The total number of GPS satellites measurements

Note: bit 7 -MSB, 0 - LSB

Max period of SNMP trap is 1sec in according to every 1second GPS sends Data message about UTC FIX status and number of satellites measurements.

Looking to status byte the critical value is less then decimal value 112 = (0x70 hex notation)

Community default name is 'public', and can be modified by user from time server web page.

OID description;

Time server sends trap type 6, and 4 OIDs binding in message.

OID (object identifier)	Description
1.3.6.1.4.1.1316.55.3.1	Server Location <string> User can modify Server location string from web implementation <i>Default value: gpsloc</i>
1.3.6.1.4.1.1316.55.3.2	Server Name <string> <i>Default value: gps</i>
1.3.6.1.4.1.1316.55.3.3	Visible satellites <integer> Total number of measurements satellites
1.3.6.1.4.1.1316.55.3.4	Status Byte <integer> describes above

NOTES:
