

# GPS NTP TIME SERVER

## Rack Version V2.2x



### Device Description:

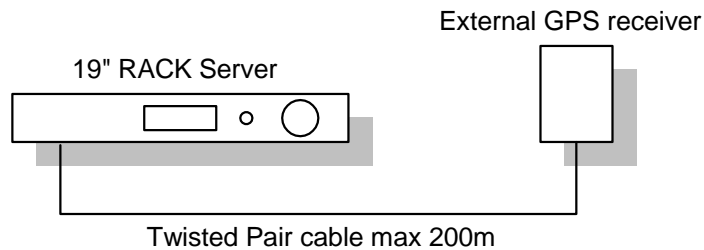
- GPS NTP Time Server is designed to synchronize local time and date of network devices such as PCs, routers.
- Devices synchronize their local time over the Ethernet using the NTP V3 protocol. (Network Time Protocol)
- The NTP Server is linked to the atomic cesium standard, placed in NIST (National Institute of Standards and Technology) over the GPS system.
- The Time Server consists of:
  - server two processor electronics, mounted in standard 19" / 1U case.
  - external GPS receiver in waterproof case.
- Server 19" case is mounting in the server room usually.
- GPS receiver with antenna in outdoor waterproof case IP-65 are mounted.
- Connection between external GPS receiver and server is made through the standard TP twisted pair cable up to 200m.

## System Topology:

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Time server consist as two components:

Main Time Server rack case and IP65 water proof external GPS receiver with active antenna.



## Technical specifications

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- **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: configurale
  - **GPS** External receiver with active antenna  
Powered from server  
Output protocol: NMEA  
Baudrate: 9600Bps  
PPS pulse: 1sec  
Cable:
    - 1 twisted pair for NMEA 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 v3  
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
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|                             |  |
|-----------------------------|--|
| • <b>SNMP protocol</b>      | Built in SNMP traps,<br>server produce and send SNMP traps to dedicated Ethernet Device,<br>- on every changes the number of satellites,<br>- UTC fix changes<br>- GPS receiver failures |
| • <b>Main processor</b>     | RISC UBICOM IP2022<br>120 MHz / for Ethernet connectivity 10BaseT  |
| • <b>GPS processor</b>      | Microchip RISC processor<br>20 Mhz<br>for GPS messages, PPS pulses, LCD ,buttons serving   |
| • <b>RTC</b>                | Real Time Clock<br>PHILIPS I2C,<br>powered from lithium CELL CR2430, User Replaceable<br>TCXO Thermal compensated quartz.<br>Max Error: +/- 2ppm   |
| • <b>Reliability:</b>       | Two processors watchdog-ing state every 1sec<br>- BOR Brown Out Reset<br>- POR power on reset<br>- two internal watchdog independent watchdog timers                                     |
| • <b>Security</b>           | User password to setup IP address, SNMP strings- community name...   |
| • <b>WEB interface</b>      | Built in WEB server for dynamic CGI WEB pages<br>- monitoring server status<br>- setup time server<br>- 4MBit dataflash  |
| • <b>Temperature ranges</b> | -25 .. 55 'C   |
| • <b>Power:</b>             | 100 .. 250 V AC / 50Hz   |
| • <b>Display</b>            | LCD 2x 16 chars<br>Green BackLight   |
| • <b>Buttons</b>            | JOG + ESC button<br>for setup IP addresses and other values  |
| • <b>Server Case</b>        | 19" rack / 1U<br>Depth: 110mm  |

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## Front Panel

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### Buttons:

On the front panel are mounted buttons:

**Rotary JOG:** to change menus and increment / decrement input values

**SET:** in the middle button of jog for enter to current menu or confirmation value

**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>

**After the power ON state, PPS Led will be not flashing approx 30..60 seconds.**

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

### Configuration

To change the current value of IP address, network mask, rotate JOG to 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 is delivered in documentation.**

**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.

**Warning:** immediately after the power ON state, this error message will be displayed approx 30...60seconds.

<**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.

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

## BACK PANEL



### FUSES:

On the server back panel two fuses are mounted:

**Fuse for GPS external receiver:** 500mA / T – Type is recommended, fuse making 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.

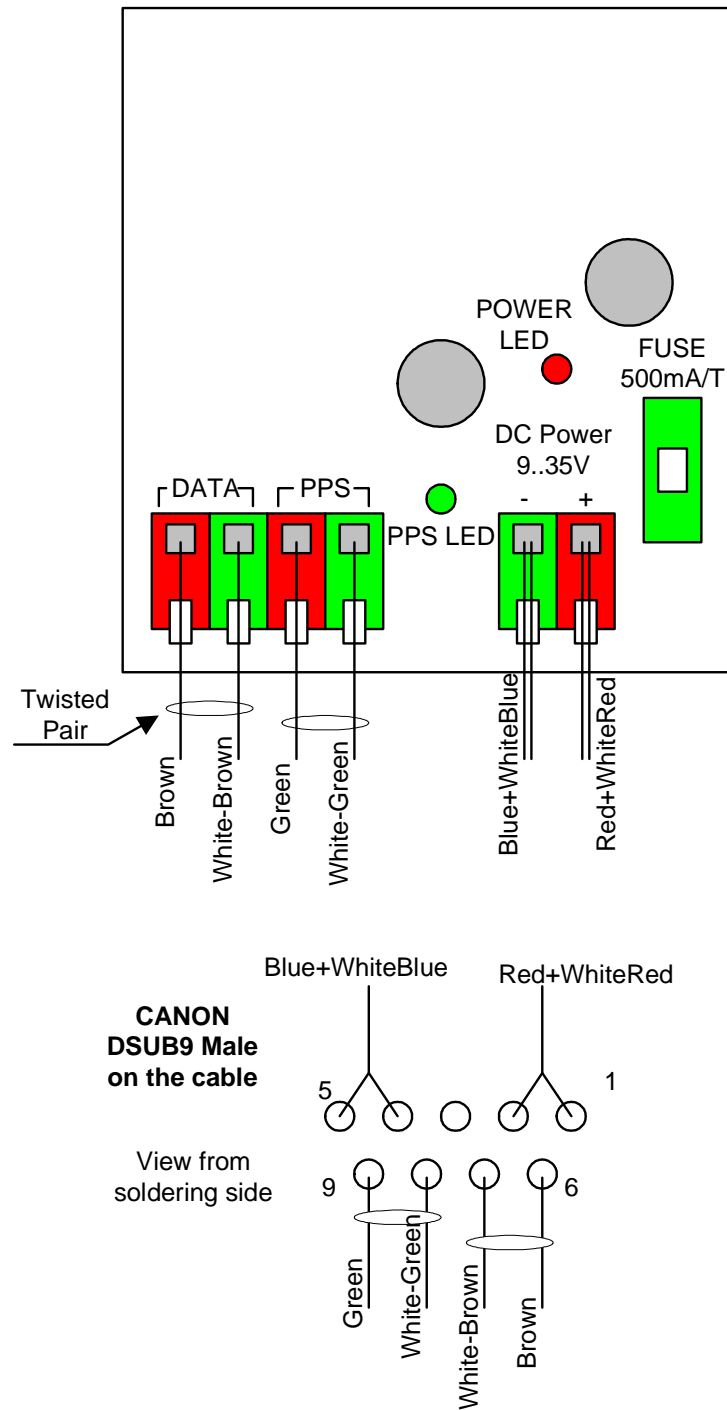
## External GPS receiver

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- Time Server is delivered with waterproof IP-65 wall mounting external receiver and built in GPS active antenna also.
- Mounted is GPS Receiver **ANTARIS CHIPSET**
- Operating temperatures: -45 .. 85°C
- Receiver is powered from Time Server with voltage 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: NMEA Connexant

**GPS External receiver wiring.**



**Notes:**

- PPS LED flashing in 1 second period approx 1 minute after the power ON.
- Connection is made by standard twisted pair cable TP , as used in Ethernet devices.
- Blue and WhiteBlue pair wires are shorted to make a lower resistance wire for DC power, also Red + WhiteRed.

## 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.

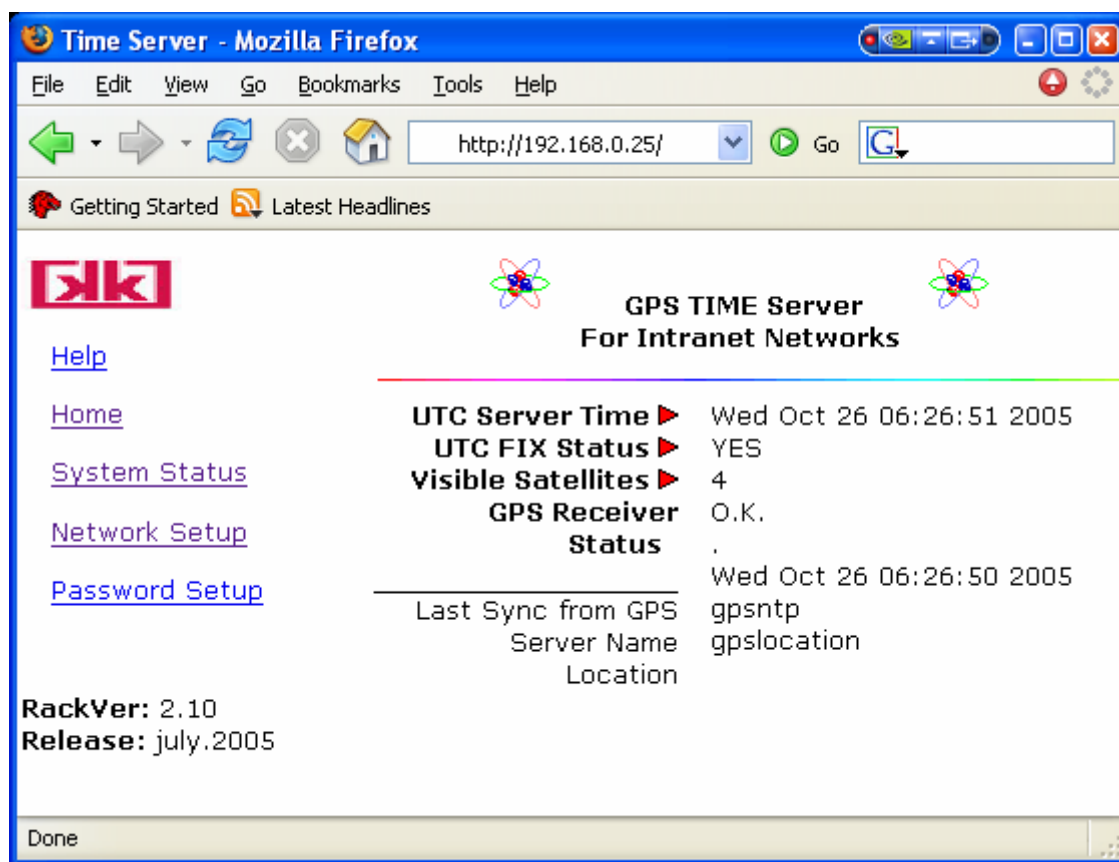
**Main Page --- index.html ---**

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

<http://192.168.0.25>

*Note: 192.168.0.25 is example, of course its needed the correct IP address of time server*

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 receiver

*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] | 11760  |
| PPS length in internal ticks  | 77067  |
| RTC Offset [usec]             | 253995 |
| Number of Lost UTC Fix        | 9      |
| Num of NTP packets received   | 6      |
| Num of NTP packets rejected   | 0      |
| Heap free system memory       | 1294   |
| 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**

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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**

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Total number of NTP packets received from any host.

### **Num of NTP packet Rejected**

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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

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**To Network setup page user will be navigate after the enter the correct password.**

- 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

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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<br>0 = PPS pulse missing / this is fatal error , GPS receiver is not connected                   |
| 5    | 1 = GPS data message present<br>0 = GPS Data missing , Fatal error, GPS receiver is not connected or NMEA Data Message cable error       |
| 4    | 1 = UTC FIX status OK<br>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  |

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*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 | <b>Server Location</b><br><string><br>User can modify Server location string from web implementation<br><i>Default value: gpsloc</i> |
| 1.3.6.1.4.1.1316.55.3.2 | <b>Server Name</b><br><string><br><i>Default value: gps</i>  |
| 1.3.6.1.4.1.1316.55.3.3 | <b>Visible satellites</b><br><integer><br>Total number of measurements satellites  |
| 1.3.6.1.4.1.1316.55.3.4 | <b>Status Byte</b><br><integer><br>describes above   |

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