



**TM2000A**

**PTP and NTP Time Server  
GPS Time Sourced**

**Installation and Operation Manual**



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## 1 Introduction

The Time Machines PTP Network Time Server is a simple to use GPS sourced time server that will supply accurate time for all computers and time keeping devices on the network. By placing a time server on the local network, PTP and NTP time packets are provided without requiring systems to go to the Internet to get a Stratum 1 time synchronization. The system uses an active GPS antenna to maintain the current time as broadcast by United States GPS satellites. With this device installed on your local network, there is no longer the worry that if the Internet connection goes down, time synchronization is lost across the network. In addition, the TM2000A includes a high precision internal clock based on an OCXO (Oven controller oscillator) that allows the unit to serve accurate time beyond loss of the GPS antenna signal.

The unit is small and can be placed anywhere within the network layout. The built in high sensitivity GPS receiver is able to lock multiple satellites from within many buildings or from a window location, removing the requirement that outdoor antennas be installed.

Setup and use of this time server is straightforward. Simply connect both the included power supply and the GPS antenna to the base unit and then connect the base unit to the local network. Go to a computer on the network and browse to the device at its default address to enter the software setup within the control box. Set parameters to match your network and the system will start to send out time packets to any device on the system that asks for an update from it. Two servers can be setup to provide redundancy and more capacity.

When paired with our digital Power Over Ethernet (PoE) or WiFi clocks, synchronized time is assured no matter the state of your network, or the state of the internet time server the clocks are pointed to. Accuracy is also improved because the network delay of the internet is highly variable, while the local LAN connection is likely sub-millisecond delay.

TimeMachine GPS based time servers are suited to any application where coordination of events at multiple locations is required. Without coordinated network time, searching for problems across multiple system logs becomes much more difficult. Education, industrial facilities, military installations, public safety command rooms, government, broadcasting, and hospitals are all candidates for synchronized time systems.

## 2 Installation

### 2.1 Location

To receive GPS signals the Time Server's antenna must be located in a location where it can “see” the sky. The GPS module itself is highly sensitive and able to “see” the GPS satellite signals from within many structures. Multi-Story or metal structures may block the GPS signals such that the antenna must be located elsewhere. In these cases, the GPS antenna may be located in a window. The Time Server box can be located anywhere on the network. All that is required is power and a wired network connection. In the worst case, an outdoor antenna may be required.

### 2.2 Connections



#### 2.2.1 Antenna

The GPS antenna is connected through the circular female SMA connector on the rear of the Time Server. By default, the GPS antenna connection provides 5.0V to power the LNA in the GPS antenna. This is correct for the supplied GPS patch antenna with the magnetic base. This voltage can be changed with a jumper on the inside of the Time Server. The Time Server has to be opened up and a jumper moved.

#### Jumper J8

A: 3.3V      B: 5.0V (default)

The only time this jumper would be changed would be to allow use of a different antenna that requires +3.3V max for the LNA in the antenna.

#### 2.2.2 Power

A +12V power supply is supplied with the unit. Connect to your local power outlet and the barrel connector to the rear of the Time Server. The time server will begin trying to find the GPS satellites. On power-up, synchronization to the GPS satellites will take several minutes. No battery backup of position is provided to allow for a warm start so the Time Server is always starting from scratch in determining its location to achieve GPS lock.

#### 2.2.3 Network

Connect the 10/100 RJ45 port on the back of the Time Server to a network connection. Verify that the network settings are correct for your system. See the configuration section of this manual for more information on doing this.

#### 2.2.4 Front Panel Indications

The front panel of the Time Server is very basic in its appearance. Three LEDs show the current status of the unit. The POW indicator indicates that the unit is receiving power through its wall power supply. The LOCK indication indicates that the GPS has located at least three satellites. The SEC LED will blink each second showing that the GPS module is now synchronized to the GPS time signals.



## 3 Configuration

**3.1 Web Page – Default username/password is “admin/tmachine”**

**3.2 Default IP address is 192.168.1.20**

All Time Server parameters are accessed on the configuration web page. The page can be accessed by pointing any web browser at the IP address of the Time Server. The initial IP address is 192.168.1.20 from the factory.

## **3.2.1 Settings Page**

### **3.2.2 TM2000 Name**

This is a generic entry that has no effect on the TM2000A operation other than to allow the user to enter a name for the device to help recognize it when parameter updates are required.

### **3.2.3 IP Address**

The IP address of the unit set to by entering a standard IPv4 dotted quad in this field. 192.168.1.20 or 10.10.0.96 are examples of acceptable formats for this field. Clicking the Submit button will set the entered IP parameters.

### **3.2.4 Broadcast**

The Broadcast entry is used to control the propagation of network broadcast packets on the network and to what level they will propagate from the device. This is frequently opposite of the Netmask setting. This is used by the PTP functions to advertise the presence of the server. Clicking the Submit button will set the entered IP parameters.

### **3.2.5 Netmask**

The Netmask entry determines what addresses are on the local network and what addresses are reached through the Gateway. Typical Netmasks are 255.255.0.0 or 255.255.255.0. Consult the network administrator for more information on how this entry should be set. Clicking the Submit button will set the entered IP parameters.

### **3.2.6 Gateway**

The Gateway IP address is used when a destination address is determine to not be on the local network. Consult the network administrator for this setting. Clicking the Submit button will set the entered IP parameters.

### **3.2.7 Timezone Pulldown**

Setting the timezone pulldown allows the unit to know what timezone it is placed in. Clicking the Submit button will set the entered IP parameters.

### **3.2.8 Password**

The Password of the unit can be changed in this field. The existing password is not displayed for security purposes. Enter the new password and click the “Change Password” button to update. The TM2000A will then prompt for the new password to be entered to continue access to the web pages.

**The default Username/Password is “admin”/“tmachine”.**

## **3.3 Status Page**

The status page is an information only page. It shows the various pieces of information about the current working state of the device.

### **3.3.1 Location**

Location shows the latitude and longitude of the device itself based on the GPS receiver.

### **3.3.2 Date/Time**

The Date/Time entry shows the current UTC date and time of the device. This is not the local time and is not updated realtime. Refreshing the page will update this time.

### **3.3.3 Time Zone**

Shows the time zone from the settings page as an offset from GMT. Subtracting this from the Date/Time display will show the current local time.

### **3.3.4 Satellites Used**

This shows the current number of satellites that are in view and locked by the GPS receiver.

### **3.3.5 GPS Fix**

This displays the level of the current GPS lock.

No GPS Fix – Check cable connections. If connected correctly, likely the antenna needs a better view of the sky. Obstructions, building materials, window tinting can all cause possible signal issues.

2D - GPS satellites found.

3D – Required for serving time.

### **3.3.6 MAC**

This is an information only field and displays the MAC address of the Time Server.

### **3.3.7 Uptime**

Time elapsed since last boot up.

### **3.3.8 Version**

Displays current software version running on device.

### **3.3.9 Satellites**

This table shows the current list of locked satellites, their signal strengths (SNR), as well as their current location over the planet. Refreshing the web page updates the table to their current values.

### **3.3.10 Clients**

This area is used to show the current PTP clients.



## **3.4 Update Page**

The update page is used to update firmware of the unit. The firmware updates will be archived and available for download from the [css-timemachines.com](http://css-timemachines.com) website. Save the file to the local computers drives. Most likely the file will need to be unzipped. The file type that is used for the update is a .img file. Browse to it using the Choose File button on the Update Page. Once the file is found the update can begin. This process takes 20 to 25 minutes and power should not be removed during the process or the device may be unrecoverable. There are periods of time where there may be little or no indication of the update process occurring, so its important to give it plenty of time. Once completed, the unit will reset and resume operation. Login to the device with a web browser to confirm the version update.

## **3.5 Diagnostics Page**

### **3.5.1 Diagnostics**

The button and checkbox associated with this portion of the web page is used to turn on and off NMEA string dump into the log file. Turning this option on and leaving it on for long periods of time is not recommended as it will increase the size of the log files dramatically.

### **3.5.2 Download Log Files**

Clicking the Download button will cause the TM2000A to create a binary format log file and initiate an HTTP download. The binary log can be used by TimeMachines as an aid in troubleshooting.

### **3.5.3 Reboot System**

Clicking the Reboot button will cause the TM2000A to do a software based reset. This is a full kernel reset of the unit and takes several seconds to complete.

## **3.6 NTP/PTP Settings Page**

The setup page can be used to turn and off the two major time server features. The current status of each is shown in its section.

### **3.6.1 NTP Server**

The NTP daemon can be started and stopped from this page. By default, NTP support is enabled once 3D lock is achieved. Click the desired option and then click the Submit button.

### **3.6.2 NTP Holdover Accuracy**

This slide bar is used to set your required accuracy during holdover when 3D lock is lost. This will range from 1ms @ 80 hrs to 10ms @ 250 hrs. The device will change to Stratum 16 when the set holdover time is expired and 3D lock is not achieved.

### **3.6.3 PTP Transmission Method**

The PTP transmission method can be set to either Multicast or Unicast. Select the desired mode of operation and click the Submit button.

### **3.6.4 Authentication Lease Time:**

This slide bar is used to set your desired authentication lease. This can range from 8 hrs to 72 hrs.

## **3.7 About Page**

The About Page shows contact information and software version of the device.

## 4 Troubleshooting

### 4.1 GPS Lock

Getting GPS lock on the Time Server is required for it to function. Most GPS lock issues come down to issues with Antenna location, or cabling. If there are problems getting GPS lock (I.e.the Lock LED doesn't turn on and the 1 PPS LED doesn't flash each second) trying moving the antenna outside and see if that resolves the issue. If it does, try a window and see if lock is maintained. If that works, move the antenna back to its original location and see if lock is lost. This will help determine where lock can be received and where it cannot. If no lock is achieved outdoors, then something is either wrong with the cabling or the Time Server itself. Contact Time Machines for help.

### 4.2 Resetting to Factory Defaults

**Front Panel Button - Push and hold the front panel button with a small object for 5 seconds. This will cause the TM2000A to reset to factory default settings.**

The front panel button, accessible with a paperclip or other small object, accessible from the front panel of the TM2000A is used to reset the units software settings to factory original. This is useful when a password is forgotten or the IP address cannot be determined. To do this, insert a paperclip or ball point pen end through the hole in the front of the unit until you feel the button depress. Hold this button down for a few seconds and release the button by extracting the paperclip/pen. It should now have the factory default password and IP address information.

## 5 Specifications

### 5.1 Time Server Features and Specifications

- Receive time information from GPS satellites anywhere on the surface of the earth
- RFC1119/1305 NTP Protocol to serve time (Network Time Protocol)
- RFC1769/2030/4330 SNTP Protocol (Simple Network Time Protocol)
- Server Time Level: Stratum 1
- NTP Server Time Precision: better than 1mS + network jitter.
- PTP Server Time Precision: better than 3uS + network jitter.
- All networked computing platforms support time synchronization either natively or with add on drivers including: Windows, Macintosh, and Linux. Many other devices can access the device as well including VoIP phones and digital clocks.
- 10M/100M adaptive network interface
- Unit is capable of serving 750+ NTP synchronizations per second. That provides support for over 600,000+ devices updating every 15 minutes on the network.
- Active Patch GPS antenna included. Magnetic base.
- Compliant with FCC Part 15B, and CE marked for radiated emissions and is a lead free product.
- Power Requirements: 5W at startup and 2.5W continuous at 12V DC
- Environmental Requirements: Commercial temperature range, 0-70C, 95% humidity non-condensing. Altitude -304m to 18,000m.
- Networking: Static or DHCP IPv4 addressing. Standard browser interface for setup.
- Indications: Power, GPS Signal Lock, and 1PPS indications
- Rear Connections: Power, Cat5 Ethernet, Serial (NOT FOR CUSTOMER USE), and GPS antenna via SMA connection. Supports +3.3V and 5V active GPS antennas with internal jumper setting.
- Mechanical Dimensions: 5 in. x 4.2 in. x 1.3in.

### 5.2 GPS Module Specifications

- Based on MediaTek MT3339 Chipset
- 22 channel low power receiver module
- Sensitivity: -165dBm
- GPS Time Precision: +/- 10ns RMS jitter.
- Antenna Connection: 1575.42MHz (L1 Band)

- TTF (Time To First Fix)
- Cold start @-125dBm typically 33 seconds
- Re-acquisition (<10s obstruction) typically 1 second

### **5.3 Antenna Specifications**

- Active patch antenna with magnetic base.
- Size: 1.57 in. x 1.89 in. x 0.51 in thick, 43 grams.
- Amplifier: LNA +20dB Noise: 1.5dB VSWR: 2.0 Voltage: 2.7-6.0V.
- Cable: RG174, 5m length, SMA male.
- Environmental: -40 to +85C
- Waterproof to IPx6

(Specifications are subject to change without notice)