

## **-GPSII- The Satellite controlled Nixie Tube Clock**



### Introduction.

Thank you for purchasing GPSII, the compact Satellite controlled Nixie Tube Clock. You are a member of a small community who own the worlds first commercially produced satellite disciplined nixie clock. GPSII began as an idea to develop the world's most accurate Nixie Tube clock by utilizing the NavStar satellite system as a precision timing reference. The project was a team effort by Jeff Thomas, and John Miktuk in the fall of 2002. Hundreds of man-hours were dedicated to the hardware and software development of this product. We hope you will enjoy the extensive list of integrated clock features.

The NavStar GPS satellites are managed by the Navstar GPS Joint Program Office at the Space and Missile Systems Center at Los Angeles Air Force Base, California, Navstar GPS is a space-based radio navigation and time distribution system. The GPS constellation consists of 24 or more satellites, which orbit the Earth in six distinct orbital planes at an altitude of 10,900 nautical miles. GPS satellites circle the Earth twice per day and continuously transmit signals, which provide navigation and timing information to military and civilian users worldwide.

GPS consists of three main elements, or "segments." In addition to the satellites themselves - - called the "Space" segment --the system includes a worldwide satellite control network -- the "Control" segment -- and GPS receiver units -- called the "User" segment. GPS receivers use the signals from the satellites to compute position and time information for users. The receivers do not send out any signals, or communicate back to the satellites.

**Lethal voltages are present on the clock PCB when power is applied. Do not remove the cover while power is applied. Keep the clock away from children. Always keep the protective cover over the electronics.**

## **Installation and Operation.**

Startup sequence:

Receiver has been placed with the foam side down, rounded side facing the sky.

Insert the 5mm barrel connector into the power receptacle on the underside of the acrylic base. Plug the AC adapter into a wall outlet.

The program revision date will be displayed on the nixie tubes for two seconds, then "Charge" will sound. After a moment, a nine will appear, and sweep across the display and decrement to zero. Colons will follow an up-down test. Last, a counter will start on the four right digits to gauge the acquisition time in minutes and seconds. The counter will continue incrementing until the receiver has acquired the satellite transmissions and their positions on the horizon. The green LED inside the clock will begin flashing at a rate of 1 pulse per second to indicate a successful clock initialization, and is seeking the satellites. If the LED is disabled in the menu, it will extinguish after the startup initialization is complete.

The GPS receiver "mouse" included with your GPSII clock is a state-of-the-art Haicom HI-204III. This receiver uses a SIRF Star III chipset, and provides the highest sensitivity of any commercial grade GPS currently available. Communication between the receiver mouse and the GPSII clock is by RS-232 serial communication. The GPSII can accommodate an extension cable of up to 50' (fifty feet) in the event your location blocks all GPS reception. The cable type is a mini DIN. Also named as a PS2 keyboard extension M/F.

The initial startup after installation after movement to a new location is known as a "cold start". The receiver begins by searching the sky to determine which satellites are currently in view, and their respective locations on the horizon. The cold start time to acquisition can be up a minute, depending on the reception signal strength. If two minutes has elapsed, and no time display is shown, the receiver should be moved to a new location without an obstruction. After the receiver has acquired the satellite transmission and their position, the clock will begin displaying the time of day, referenced to UTC or Greenwich time (also known as Zulu time for you military folk).

The setup menu is activated by waving the provided magnetic wand<sup>1</sup> over the Menu switch, SW1, located near the center of the clock. Menu items are modified by waving the wand over the Set switch SW2 near the right edge of the clock. This method allows you to make adjustments without removing the Acrylic cover. This protective cover must be in place whenever the clock is powered up; high voltage is present on many components.

The menu item number is displayed on the leftmost display digits, while the values are displayed on the right. Select the desired menu option by waving the magnet over the Menu switch, then set the desired value by waving it over the Set switch. The display will automatically return to the time display after 10 seconds with no input from the Menu or Set switch. Alternately, you can wave over the Menu switch to the end of the Menu list to return to the clock display.

All menu items are stored in non-volatile flash memory. Settings are retained indefinitely when the clock is powered down.

## **Menu Settings.**

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<sup>1</sup> The magnet is quite strong. Keep it at least one meter away from your computer, floppy disks or anything else that can be damaged by a strong magnetic field.

- 1) UTC<sup>2</sup> Offset Hours: this sets your time zone, expressed as the number hours ahead or behind of UTC. You can set values from 0 to 14. Example: in the USA, Eastern time is 5 hours and Pacific time is 8 hours. You will set ahead or behind UTC in menu item 3.
- 2) UTC Offset Minutes: some areas of the world have UTC offsets of half-hours. You can set this value to either 0 or 30 minutes. In most cases this will be set to 0.
- 3) Offset Direction: this determines whether time offset time set in 1) and 2) is ahead or behind of UTC. 0 = behind UTC, 1 = ahead of UTC. Example: the USA is behind UTC, so this value would be set to 0.
- 4) 12 or 24 Hour Display: your GPS-II will display time in either 12 hour format with AM/PM indication<sup>3</sup>, or in 24 hour "military" format with no AM/PM indication. 12 = 12 hour format, 24 = 24 hour format.
- 5) Scroll Frequency: your GPS-II will periodically scroll your location, date, temperature and other information you select. Select the items to be scrolled in menu items 8 - 11. You can specify 0 to suppress scrolling, or 1, 5, 15, 30 or 60 minute scrolling intervals.
- 6) Scroll Speed: this determines how quickly the digits scroll by during scrolling. 0 = slowest, 9 = fastest.
- 7) Scroll Dwell: after scrolling data onto the display, the clock will pause for you to read it. 0 = shortest dwell time, 9 = longest dwell time.
- 8) Coordinate Scrolling: 0 = disabled, 1 = enabled. You location coordinates are scrolled in degrees, decimal minutes and decimal seconds, in accordance with the NMEA-0183 specification.
- 9) Temperature Scrolling: 0 = disabled, 1 = enabled in degrees Centigrade, 2 = enabled in degrees Fahrenheit.
- 10) Temperature Sensor Offset: this setting allows you to make fine adjustments to the temperature readout. Adjustment range is +3.75 degrees C to - 3.75 degrees C in 0.25 degree C steps. The lower left colon bulb indicates a negative offset value.
- 11) Date Scrolling: 0 = disabled, 1 = scroll date in European format (Day-Month-Year), 2 = scroll date in US format (Month-Day-Year).
- 12) Chime Frequency: your GPS-II will chime at intervals you select. Set 0 to suppress chiming, or set the chime interval to 1, 5, 15, 30 or 60 minutes.
- 13) Chime Style: 1 = single chime, 2 = double chime, 3 = chime high/low, 4 = chime low/high, 5 = Tick-Tock, 6 = Morse Code hours announcement, 7 = Mantle clock style hours chime, 8 = Naval Bells: Royal Navy with dog watches<sup>4</sup>, 9 = Naval Bells, US Navy, no dog watches. Selections 1 - 4 are simple chimes which do not indicate the hour.

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<sup>2</sup> UTC is the international acronym for "Coordinated Universal Time", the newer name for Greenwich Mean Time (GMT) or "Zulu Time".

<sup>3</sup> The neon bulb at the left side of the display indicates PM when lit. It is never on when the 24 hour format is selected.

<sup>4</sup> Shipboard watches are generally 4 hours long, with 1 - 8 bells rung each half hour. However, the British Navy includes two 2-hour watches called "Dog Watches" from 1600 - 1800, and 1800 - 2000. The US Navy has no Dog Watches: all watches are 4 hours long.

- 14) Morse Code Speed: this sets the speed of Morse Code hour announcement, if selected in menu item 13. The range of adjustment is 5, 13, 20, 30 or 40 words per minute<sup>5</sup>.
- 15) Display Wake Brightness: this sets the display brightness during normal viewing hours, as set in menu item 17. 1 = dimmest, 9 = brightest
- 16) Display Sleep Brightness: this sets the display brightness during sleep hours, as set in menu item 17. 0 = off, 9 = brightest. If the display brightness is set to off, the high voltage supply is powered down.
- 17) Display Sleep Hour (Turn Off): this sets the hour at which the display will switch to sleep mode brightness, as set in menu item 16. Range of adjustment is 0 - 23.
- 18) Display Wake Hour (Turn On): this sets the hour at which the display will switch to wake mode brightness, as set in menu item 15. Range of adjustment is 0 - 23. The display may be temporarily awakened from Sleep mode by waving the magnet near either the Mode or Set switch. The display will return to Sleep mode after one minute.
- 19) LED Flash: this sets whether the green LED on the processor board flashes during normal operation. 0 = disabled, 1 = enabled. The green LED will flash during startup even if this item is set to disabled.
- 20) Leading Zero: this determines if single-digit hours will be shown with a leading zero. 0 = disabled (no leading zero), 1 = enabled (leading zero present). This applies to the 12 hour mode only, as set in menu item 4. 24 hour time will show a leading zero regardless of this menu item setting.
- 21) Automatic DST Changeover: your GPS-II can automatically adjust for daylight savings time. 0 = disabled (the clock will not automatically adjust), 1 = USA, 2 = Europe, 3 = Australia, 4 = Manual in the Northern Hemisphere, 5 = Manual in the Southern Hemisphere.  
NOTE: DST data stored in clock is obsolete as of 2007. After dubya (dipshit) Bush permitted a change that resulted in millions of dollars in losses to mfgs who relied on data that was to be valid until the year 2099. May he rot in hell.

Menu items 22 - 25 are available only if item 21 is set to option 4 or 5.

The GPS satellites themselves do not provide DST changeover information. Your GPS-II can automatically calculate the changeover based on pre-computed data stored in its processor, good through 2099. If you live in an area that is not supported by this data, you can manually set the month and day for the changeover. The manual changeover dates are valid only for the year programmed.

- 22) Set start Month if in the Northern Hemisphere, End Month if in the Southern Hemisphere
- 23) Set start Day if in the Northern Hemisphere, End Day if in the Southern Hemisphere
- 24) Set end Month if in the Northern Hemisphere, Start Month if in the Southern Hemisphere
- 25) Set end Day if in the Northern Hemisphere, Start Day if in the Southern Hemisphere

If this seems confusing to you, join the club. You'll have to study a globe for a while to understand why the offset menu separates the Northern and Southern Hemispheres.

## **Alarm Feature.**

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<sup>5</sup> The official record for copying Morse code, 75 words per minute, was set by Ted "Mac" McElroy in 1939. His record still stands today.

Your GPS-II has a single alarm that can be accessed by holding the magnet near the Set switch for two seconds. The alarm set mode is indicated when the left two Nixie tubes display 50. If you accessed this menu by accident, the display will return to normal operation after 10 seconds.

50) Alarm Enable/Disable: 0 = disabled, 1 = Enabled. When enabled, at the alarm time the clock will play a few bars of the tune "Menomonee", then automatically reset to alarm again 24 hours later.

51) Alarm Hour: this sets the hour of the alarm time. Range of adjustment is 0 - 23 hours.

52) Alarm Minute: This set the minute of the alarm time. Range of adjustment is 0 - 59 minutes.

### **Secondary precision reference.**

If the GPS signal is weak or obstructed after the clock has received the satellite transmission and successfully locked, the clock will continue operation without continuous satellite reception. The GPS receiver contains an internal uncompensated time base that continues to send the timing pulses to the clock when reception is interrupted.

### **The right lower colon indicator will extinguish upon GPS signal loss; indicating that the clock is now operating from the satellite receiver's internal time base.**

The lower right colon indicator will be illuminated whenever the satellite signal is being received.

If you notice frequent periods of signal loss, you should move the receiver to a location without obstructions.

### **Temperature Sensor.**

**The temperature sensor for your GPSII clock is suspended below the base from a short pigtail. The sensor is remote mounted to eliminate any weighting that may be incurred by heat generated from the clock electronics.**

A digital IC is enclosed in the black boot, and transmits the ambient temperature to the microprocessor. Manufacturing differences in the sensor can result in an error of + - 1 degree C. Any error can be eliminated by entering an offset value in the GPSII menu.

### **Care of the Acrylic enclosure.**

Clean the acrylic enclosure and base with a dampened clean towel. Do not use ammoniated or alcohol base cleaners on either item. Strong cleaners may cloud or damage them.

### **Troubleshooting.**

After applying power, the display is dark, and the LED does not flash:

Check fuse F1.

Check output voltage of AC adapter.

### **Warranty.**

GPSII is guaranteed to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. Allowances for problems shortly after the warranty expiration may be considered on a case-by-case basis at the discretion of the manufacturer. Failures caused by damage, misuse, or altering, are not covered under the warranty.

Jeff Thomas

Resonant Instruments LLC

2041 E. Cortez Drive

Gilbert, Arizona

(480) 516-4523

email: [jthomas@amug.org](mailto:jthomas@amug.org) or <http://www.gpsii.com>