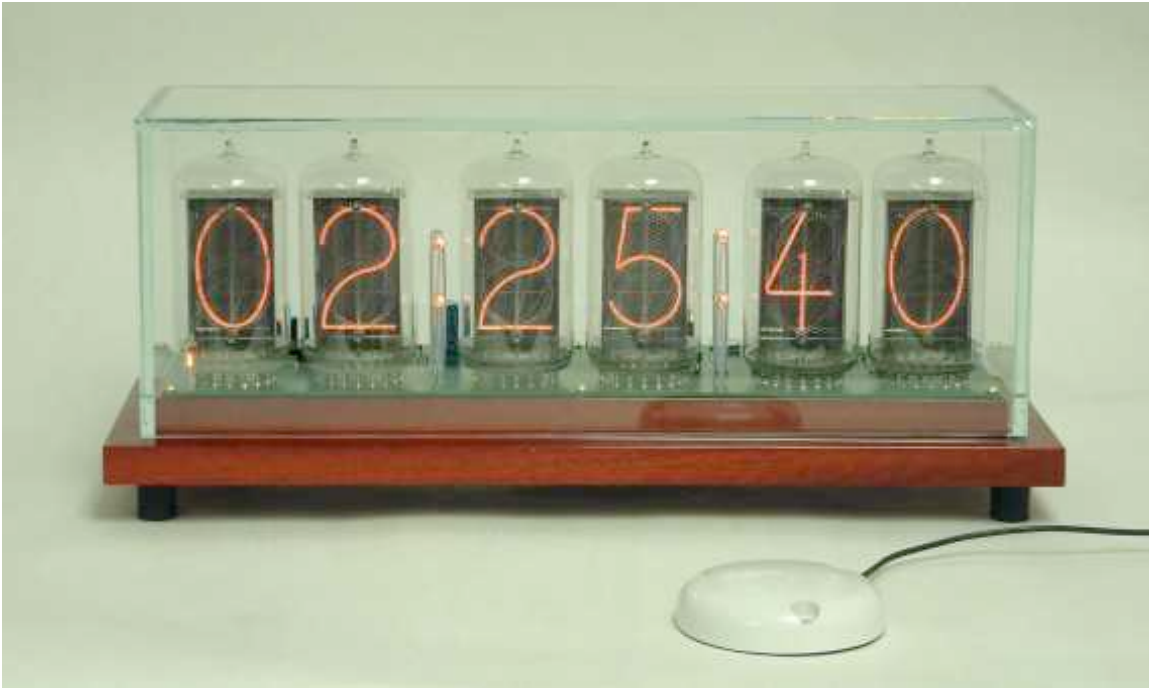


-NixiSat- The Satellite controlled Nixie Tube Clock



Introduction.

Thank you for purchasing NixiSat, the Satellite controlled Nixie Tube Clock. You are a member of a small community who own the worlds first commercially produced satellite disciplined nixie clock. NixiSat 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 established as a team effort by Jeff Thomas of Mesa, AZ, and John Miktuk of Panama NY, beginning in the fall of 2002. Hundreds of man-hours were dedicated to the hardware and software development of this product. We hope you enjoy the extensive list of integrated features in your ultra-precise timepiece.

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 .

Never connect or disconnect the antenna from the GPS receiver while the clock is powered. The GPS receiver can be damaged.

Installation and Operation.

Startup sequence:

Antenna has been placed with a clear view skyward, and the lithium battery is installed. 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 run an up-down test. Last, a counter will start on the four right digits to gauge the acquisition time. The counter will continue incrementing until the receiver has acquired the transmissions from satellites in view and their almanac information.

Place the GPS receiver antenna in a location with no obstruction from the sky. Wood frame single story homes may permit operation with the antenna located inside the structure. Multi-story, or hi-rise buildings require the antenna to be placed on a window ledge or support with a clear sky view.

Don't mount the antenna at the highest elevation. **It will not improve reception. A high mounting will create a lightning hazard.** Simply provide it a clear, unobstructed view skyward. Mounting the antenna a few feet from the ground will work adequately, and reduce the chance of damage or injury by lightning.

If you are unable to mount the antenna externally, placing the antenna on the inside of a window sill will achieve partial satellite reception. The lower right colon will regularly extinguish, indicating that the signal has been lost. Though the colon will flicker at times; no perceivable degradation in accuracy will occur, even when measured against other timing instruments.

The initial startup after installation or after replacement of the Lithium battery is known as a "cold start". All ephemeris data is lost, along with satellite position information. 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 to 30 minutes, depending on the signal strength received. If 30 minutes has elapsed, and no satellites were acquired, the antenna will need to be moved to a new location without obstruction.

After the receiver has acquired the satellite transmissions and their position, the clock will begin by displaying the time of day, referenced to UTC or Greenwich time (also known as Zulu time for you military folk).

After acquisition, if the main power to the clock is lost, the receiver will retain the critical satellite data, and will resume operation within 2 minutes of the power being restored; as long as a signal is being received. The CR2032 Lithium battery is responsible for maintaining the receiver's memory power.

Setup menu.

NixiSat can be configured for operation in any time zone. All display and scrolling features are enabled from a menu. The menu items are accessed by actuating MODE SW1; a magnetic reed switch located near the centerline at the back of the clock. By waving the included rod magnet near SW1, the first of twenty one menu items will appear. The individual menu assignments are changed by waving the magnet near SW2 located at the right rear edge of the clock.

The menu items are displayed on the left digit of the display. Holding the magnet near SW1 will slowly increment the menu item number, finally returning to the time display after the last menu item. Each switch actuation will generate an audible tone. When the menu item you wish to change is displayed, wave the magnet near SW2 (the switch near the edge at the rear of the PCB) to change the setting shown on the right digits. After you have completed the change, wave the magnet near SW1 to advance to the end of the menu and exit. Alternately, the menu display will return to normal clock operation after ten seconds with no switch input. The setup menu is activated by waving the provided magnetic wand¹ over the Mode switch, SW1, located near the center of the clock. Options are selected 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 Mode switch, then set the desired value by waving it over the Set switch. The display will automatically return to the time

¹ 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.

display after 10 seconds with no input from the Mode or Set switches. Alternately, you can wave over the Mode 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, and even if the Lithium battery is removed.

Menu Settings.

- 1) UTC² 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 indication³, 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 =

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

³ 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.

Naval Bells: Royal Navy with dog watches⁴, 9 = Naval Bells, US Navy, no dog watches.
Selections 1 - 4 are simple chimes which do not indicate the hour.

- 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 minute⁵.
- 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 dubbya (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 precomputed 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.

⁴ 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.

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

Alarm Feature.

Your NixiSat 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.

Menu settings are permanently saved in non-volatile Flash memory. In the event of a power loss or the Lithium battery is removed, all menu assignments are retained.

Secondary precision reference.

NixiSat incorporates a unique method of operation in the event of "spotty" reception resulting from poor or limited antenna placement possibilities.

If the signal is weak or obstructed after the clock has received the satellite transmission, the clock will continue operation without continuous satellite reception. The GPS receiver contains an internal time base that is used temporarily as the reference to continue operation. Any cumulative error during short duration signal losses will likely go unnoticed, and even with an extended signal loss over a period of hours.

NOTE:

The Latitude and Longitude coordinates will remain fixed until reception has been restored.

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

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

Intermittent reception is normal. The satellites are constantly moving in an orbit over your location. As one satellite signal grows in strength, another will decrease; and sometimes results in signal loss if the antenna is not capable of seeing the entire horizon.

If you are concerned over frequent periods of signal loss, you should reposition the antenna to a location without any obstruction from the sky.

Care of the Acrylic enclosure and lacquered wood base.

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.

The base of your NixiSat clock is lacquered American Walnut or American Cherry. No stain was applied to achieve it's fine appearance. Many coats of clear lacquer finish were applied and prepared entirely by hand. These same processes are used in fine furniture manufacturing.

Take care in handling the base. The lacquer finish can be damaged or chipped easily in rough handling. Lacquer is brittle and may chip or bruise.

Temperature Sensor.

The temperature sensor for your NixiSat 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 NixiSat menu.

Troubleshooting.

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

Check fuse F1.

Check output voltage of AC adapter.

Multiple digits are illuminated in each tube, or not all tubes are being lighted.

Damaged or defective Nixie tube, or driver electronics.

The clock appears operational, but only shows the timer on the right four digits.

No signal. The clock was never able to initialize to the satellites. A valid satellite signal is required upon startup. If none is available, then the clock cannot synchronize the nixie tube display. Change your antenna placement location.

When the clock was powered off, it required 30 minutes to begin displaying time again.

Check battery B1, it should read about 3v in circuit. Also check your antenna placement.

Warranty.

NixiSat 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.

We have been designing and building high precision Nixie Tube Clocks since year 2000.

In the unfortunate event of problems, or if you have questions, please call or email.

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