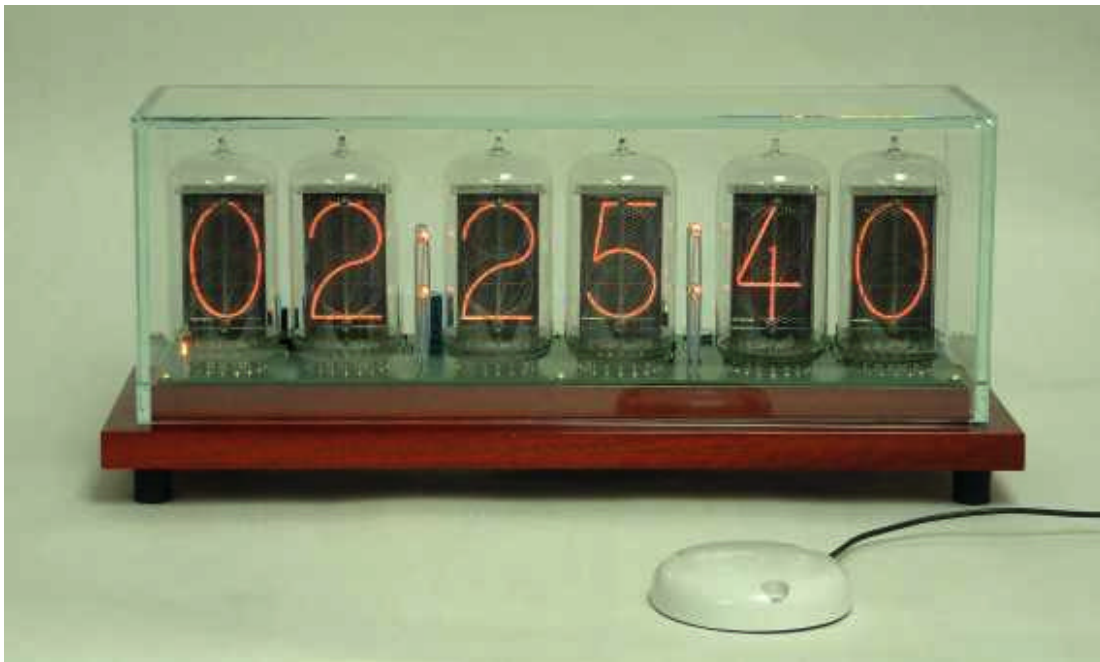


-NixiSat- The Satellite controlled Nixie Tube Clock



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 may 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 satellite transmissions and their positions on the horizon.

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.

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

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.

- (1) UTC OFFSET HOURS. Range of adjustment is: 0 to 14 hours. *An example UTC offset for USA pacific time is 8 hours, where USA eastern time is 5 hours*
- (2) UTC OFFSET MINUTES. Range of adjustment is: 0 OR 30. Yes, there are some countries off set by 30 minutes from UTC.

- (3) OFFSET DIRECTION. Range of adjustment is: 0 = (negative) for USA, or 1 = (positive) for Europe. *For USA clock owners, this setting should be set to 0*
- (4) 12 OR 24 HOUR DISPLAY. Range of adjustment is: 12 = 12 hour display, and 24 = 24 hour display.
- (5) SCROLL FREQUENCY. Range of adjustment is: 0, 1, 5, 15, 30, 60 minute interval. *Assigns how often the display will scroll the enabled features.*
- (6) SCROLL SPEED. Range of adjustment is: 0 = slowest, and 9 = fastest in a range of ten steps. *Assigns how quickly the digits fly by during the scrolling cycle.*
- (7) SCROLL DWELL . Range of adjustment is: 0 = shortest, and 9 = longest in a range of ten steps. *Assigns the length of time the scrolled feature remains on the display.*
- (8) COORDINATE SCROLLING. Range of adjustment is: 0 = Disabled, 1 = Enabled. Latitude and Longitude, represented in degrees, decimal minutes, and decimal seconds. As defined in the NMEA-0183 specifications.
- (9) TEMPERATURE SCROLLING. Range of adjustment is: 0 = Disabled, 1 = Scroll in degrees Centigrade, 2 = Scroll in degrees Fahrenheit.
- (10) TEMPERATURE SENSOR OFFSET. Range of adjustment is: + 3.75 degrees C to - 3.75 degrees C, in quarter degree C precision. *Left lower colon represents a negative offset value.*
- (11) DATE SCROLLING. Range of adjustment is: 0 = Disabled, 1 = Scroll Date European format, 2 = Scroll Date US format.
- (12) CHIME FREQUENCY. Range of adjustment is: 0, 1, 5, 15, 30, 60 minute intervals. *Assigns how often the chime will strike.*
- (13) CHIME STYLE. Range of adjustment is: 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, 9 = Naval Bells: US Navy, no dog watches
Selections 1-4 are a simple chime, the specific hour is not indicated in the chime.
- (14) MORSE CODE SPEED. Range of adjustment is: 5, 13, 20, 30, 40 WPM.
- (15) DISPLAY WAKE BRIGHTNESS. Range of adjustment: 1 = Dim, 9 = Bright
This item assigns the display brightness level during normal viewing hours.
- (16) DISPLAY SLEEP BRIGHTNESS. Range of adjustment: 0 = Off, 9 = Bright.
This item assigns the display brightness level during display sleep hours. If set to zero, the HV supply will be completely disabled.
- (17) DISPLAY SLEEP HOUR (TURN OFF). Range of adjustment is: 0 – 23
Using your time zone offset, this assigns the hour that the clock display will turn off.
- (18) DISPLAY WAKE HOUR (TURN ON). Range of adjustment is: 0 – 23
Using your time zone offset, this assigns the hour that the clock display will turn on.

The display can be temporarily awakened from the sleep cycle by waving the magnet near SW1 or SW2. The display will return to sleep one minute since last activation.

The display can also be awakened in input to RB4. See advanced info for details.

- (19) 1PPS LED FLASH. Range of adjustment is: 0 = Disabled, 1 = Enabled.
The LED will always signal at startup, then can be disabled during normal operation.
- (20) LEADING ZERO. Range of adjustment is: 0 = Disabled, 1 = Enabled.
Applies to 12 hour mode only. If hours are less than 10, the leading zero can be disabled from the time display.
- (21) AUTOMATIC DST CHANGEOVER (SUMMER TIME) Range of adjustment is: 0 = Disabled, 1 = USA, 2 = Europe, 3 = Australia, 4 = Manual N. Hemisphere, 5 = Manual S. Hemisphere.

NOTE: Menu items 22-25 are available only when manual modes 4 or 5 have been selected.

The GPS satellite transmissions do not contain offset information for DST changeover. Automatic DST changeover has been calculated and stored in a memory table contained within the programmed MCU. All automatic DST changeover dates are valid until the year 2099. Countries not supported by the automatic DST changeover menu choices can manually program the month and day for start/finish. The manual changeover dates are valid only for the year programmed.

- (22) SET START MONTH IF NORTHERN, END MONTH IF SOUTHERN.
- (23) SET START DAY IF NORTHERN, END DAY IF SOUTHERN.
- (24) SET END MONTH IF NORTHERN, START MONTH IF SOUTHERN.
- (25) SET END DAY IF NORTHERN, START DAY IF SOUTHERN.
Confused? You are not alone. Look at a globe, you will understand why the manual offset menu separates the northern hemisphere from the southern hemisphere.

ALARM FEATURE.

Your clock supports a single alarm feature that can be accessed by holding the magnet near SW2 for two seconds.

The alarm menu is indicated when the left two Nixie tubes display 50. If you accessed the menu by accident, the clock will return to normal operation after 10 seconds with no input.

- (50) ALARM ENABLE / DISABLE. Range of adjustment is: 0 = Disabled, 1 = Enabled.
When enabled, the clock will play a few bars of Menomnie, then reset to alarm again in 24 hours.
- (50) ALARM HOUR. Range of adjustment is: 0-23 hours.
- (51) ALARM MINUTES. 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.

Program updates.

The NixiSat program software is a work in progress. As the customer base increases, requests for features and improvements are being accepted and added in future program releases.

Please download the latest revision of the NixiSat_Operation.pdf user manual on the nixisat.com web page for updates and feature additions to the menu. Please email to inquire about future program updates for your clock.

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 high-precision time base that is continuously compensated by the Cesium atomic reference transmitted from the satellites. Any cumulative error will be unnoticed, even with an extended signal loss over a period of days.

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.

Jeff Thomas
Resonant Instruments LLC
55 W. Hoover Ave. Suite 1
Mesa, AZ 85210

(480) 898-1195

email: jthomas@amug.org or <http://www.nixisat.com>