

-NixiChron- The Satellite controlled Nixie Tube Clock



Introduction.

Congratulations on selecting the NixiChron, an irresistible combination of retro 1950s Nixie Tube display technology and state-of-the-art, satellite-based timekeeping principles. You are now a member of an elite community of those who own a GPS satellite referenced Nixie Tube clock.

The Nixie Tube is a cold-cathode glow discharge indicator. The glow effect of the illuminated digit is a result of ionizing Neon gas surrounding a cathode element in the shape of a wire formed digit. A Penning mixture of Neon and Argon gas are added to the high vacuum environment within the tube. Trace amounts of mercury are included in the mix as a cathode replenishment agent, and is responsible for the purple color at the perimeter of the glass envelope when viewed in a darkened room.

The nixie tubes provided in your clock were manufactured long ago, beginning in the 1960's in the former USSR, and more recently in the Russian republic until production ended in 1992. Originally intended for numeric instrumentation display, and often used in military defense equipment, their final application as a clock display are a serendipitous end for these wonderful glowing numeric indicators.

Minimum Nixie tube life is conservatively estimated at 50,000 hrs (10+ years) of continuous 24hr operation. Although replacement nixies are readily available, we recommend you set your clock to disable the display during the nighttime hours to extend the service life of the nixie tubes.

Nixie Tubes are manufactured from glass and are extremely fragile. Take care in deciding where to place your clock, and ensure that none of the wiring from the antenna or power modules could be a trip hazard.

Installation and Operation.

Startup sequence:

Insert the connector from the antenna module lead into the receptacle on the back of the clock, with the outer flat molded key facing downward. If the 25' extension is required for your installation requirements, install it between the antenna module and the clock now. Place the antenna module on an inside windowsill, or outside with a clear view skyward. The bottom of the receiver module contains a magnet to help hold it securely to a steel surface. Reception can be improved by placing the receiver magnet in contact with a flat metal surface, and it will act as a ground plane. The top side of the receiver containing the square antenna element must face directly vertical to the sky, preferably with an unobstructed view of the horizon.

Insert the 5mm barrel connector from the power adapter into the power receptacle on the back of the clock. Plug the AC adapter into a wall outlet.

The program revision date will be displayed on the nixie tubes for two seconds, and then "Charge" will sound from the alarm speaker. After a moment, a nine will appear, and sweep across the display and finally decrement to zero. Colons will then run an up-down test. Last, a timer will begin, using the four right digits to gauge the satellite acquisition time. The timer will continue incrementing until the receiver has acquired a minimum of three individual satellites, their almanac data, and their respective positions on the horizon.

A red LED, located inside the antenna module will begin flashing at three second intervals to indicate successful receiver power up and initialization. The LED will continue to flash slowly until a minimum of three satellite signals have been acquired and processed. After acquisition, the LED will begin flashing faster (once per second) to indicate the receiver has achieved a lock, and the NixiChron will display the time immediately thereafter.

If at a later time the LED begins to flash slowly after successful lock (or the lower right colon of the clock display is dark), it is indicating that the receiver is out of GPS lock because the satellite signal has been lost, and it is attempting a reacquisition. Short periods of signal loss are completely normal with obstructed (not full horizon) view, although they should not exceed 1-2 minutes on average. For best performance, the antenna module can be placed at a location where the LED remains flashing at a once per second rate.

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 GPS receivers do not send out any signals, or communicate back to the satellites.

An inside window sill usually works very well when multi-story, or hi-rise buildings require the module to be placed near the outside of the building with a partial sky view.

The GPS antenna module is not completely weatherproof, and cannot be placed outside if exposed to rain or moisture.

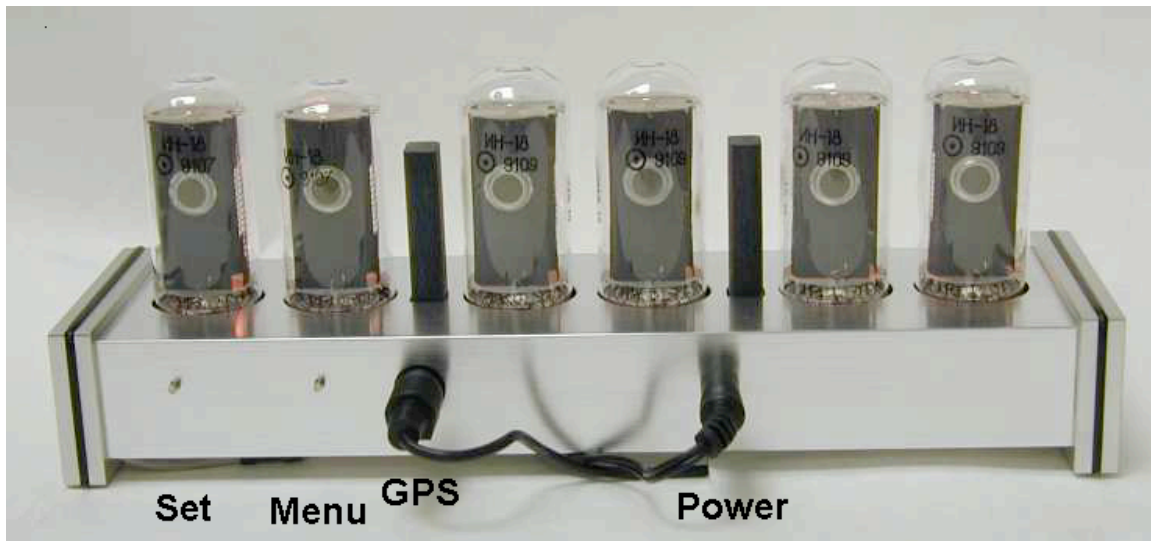
Don't mount the antenna at the highest elevation. **It will not improve reception. A high mounting will create a lightning hazard.** Simply provide it an unobstructed view skyward. Mounting the antenna a few feet from the ground will work adequately, and reduce the chance of damage or injury by lightning.

The initial startup after installation 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 5 minutes, depending on the signal strength received. If 5 minutes has elapsed, and the red LED inside the module is still flashing slowly at a rate of once every three seconds, the module will need to be moved to a new location without an obstruction of the GPS satellite transmissions.

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). In some cases, I have preset your clock to the correct time zone before shipment.

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.

NOTE: Never connect or disconnect the antenna module while the clock is powered. The antenna / receiver module can be damaged.



Menu Settings

- 1) UTC¹ 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.

¹ UTC is the international acronym for "Coordinated Universal Time", the newer name for Greenwich Mean Time (GMT) or "Zulu Time".

- 4) 12 or 24 Hour Display: your NixiChron will display time in either 12 hour format with AM/PM indication², or in 24 hour "military" format with no AM/PM indication. 12 = 12 hour format, 24 = 24 hour format.
- 5) Scroll Frequency: your NixiChron 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 NixiChron 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 watches³, 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 minute⁴.
- 15) Display Wake Brightness: this sets the display brightness during normal viewing hours, or as set in menu item 18. 1 = dimmest, 9 = brightest
- 16) Display Sleep Brightness: this sets the display brightness during sleep hours, or as set in menu item 17. 0 = off, 9 = brightest. If the display brightness is set to off, the high voltage nixie tube power supply is disabled.
- 17) Display Sleep Hour (or 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.

² 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.

³ 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.

⁴ The official record for copying Morse code, 75 words per minute, was set by Ted "Mac" McElroy in 1939. His record still stands today.

- 18) Display Wake Hour (or 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 pressing either the Mode or Set switches. 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. Note: the green LED is not visible to the user on the metal enclosed NixiChron clock.
- 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. Not Supported if 24 hour display mode is selected.
- 21) Automatic DST Changeover: your NixiChron 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.

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 NixiChron 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

Your NixiChron has a single alarm that can be accessed by pressing and holding 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 clock reference.

NixiChron utilizes the GPS receiver's internal time base to continue operation in the event of "spotty" satellite reception resulting from poor or limited antenna placement possibilities. If the signal is weak or obstructed after the clock has initialized by the satellite transmission, the clock will maintain operation without continuous satellite signal reception. The GPS receiver internal time base is not calibrated, and will result in measurable drift during long periods (hours) of signal loss. Reception may be improved by selecting a different antenna location.

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

The lower right colon indicator will be illuminated when the satellite signal is being received. If you notice frequent periods of signal loss, you should move the antenna module to a location without any obstructions from the sky.

Temperature Sensor.

The digital temperature sensor for your NixiChron clock extends below the base from a short pigtail. The sensor has been externally mounted to eliminate any thermal weighting that **may influence the sensor that is generated by 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 NixiChron setup menu.

Care of the anodized aluminum enclosure and Nixie Tubes.

Disconnect power from the clock. Clean the aluminum enclosure with a lightly dampened clean towel. Do not use ammoniated cleaners, or spray the enclosure directly with a liquid cleaner. Allow the moisture to evaporate before restoring power to the clock.

The Nixie tubes can be cleaned with a lightly dampened towel in the same procedure as noted above. To extend the life of the nixie tubes, use the programmable display disable feature to turn off the display during the night time hours.

Static Electricity.

NixiChron is sensitive to damage by static electricity discharge, and may initiate a reset if the metal clock enclosure is touched while carrying a static potential. Place your clock away from areas where it is likely to be touched on a regular basis. A ground strap attached to the enclosure is recommended in areas of high traffic and static electricity potential.

Troubleshooting.

After applying power, the display is dark, and the LED in the receiver module does not flash: Check output voltage of AC adapter.

If 12vdc is indicated, please contact me for a return authorization for repair.

There are no user serviceable parts inside the NixiChron clock.

Warranty.

The NixiChron clock kit is guaranteed to be free of defects in materials 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. Return shipping costs for repair or assistance are the responsibility of the clock owner.

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