1 Glass Clock Design #3

Congratulations on your purchase of this unique timepiece! This clock uses Cold War era Nixie display tubes. The old is mixed with the new, using a RISC processor based single chip computer – which has more processing power than the old computers that originally used these Nixie tubes.

The case is all optically clear Simax glass from the Czech Republic, and uses clear acrylic support pieces to complement the glass vacuum tube construction of the Nixies.

“Стекло часы Дизайн номер 3”, or “Glass Clock Design #3” is the third design for my Nixie tube based clock. It uses a microprocessor that multiplexes 3 tubes by 2 (meaning 2 tubes are on at a time, with 3 sets of 2). SMD (surface mount) construction is used throughout. A high efficiency high voltage power supply is used to generate the 180v required for the Soviet Nixie tubes.

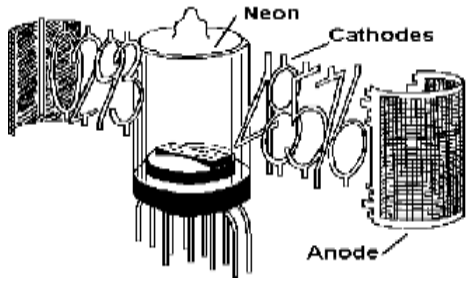
This clock either uses rare Soviet IN-8-2 tubes, or the IN-14 tubes. Each tube is socketed to the board, which allows easy replacement if a tube fails. It’s an excellent size for larger offices and living rooms.

2 Introduction to Nixie Tubes

Nixie tubes (gas indicator tubes) were invented during the Cold War in the early 50's by a small vacuum tube manufacturer called Haydu Brothers Laboratories. These tubes were sold by the Burroughs Corporation, who came up with the trade name “Nixie”. This name refers to "NIX I", an abbreviation that stood for, "Numeric Indicator eXperimental No. 1”, which was a label for one of the drawings for the tube. This was shortened to “NIXIE” and the name stuck.

Early computers and test instruments didn't have any means to display digits easily until the Nixie tube appeared. Nixies found their way into numerical computer displays, volt/ohm meters, frequency counters, radiation counters and even calculators. By the mid 1970's, they were obsolete (replaced by LED's and LCD displays) and were discontinued.

A Nixie tube display, which should really be called a gas indicator tube, works like a neon bulb. A neon bulb works by a high voltage ionizing neon gas, causing the gas to glow with an orange color. The Nixie tube takes this a step further, by shaping the cathodes like a numeral (0 – 9). When the cathode is energized, the numeral glows orange. There are individual cathodes for each digit, 0 – 9. Some tubes have decimal points, and others may contain special characters, such as “F” or “Hz”.



Nixie tubes require high voltage with special drivers for each digit, provided by a special high voltage converter on the circuit board. There are many failure modes for Nixie tubes: Breakage of the glass tube, loss of seal between the metal pins and the glass, and cathode poisoning. Cathode poisoning is when unused or seldom-used digits acquire a coating of material “sputtered” off of the active digits. This coating insulates the metal, making it difficult for the digit to glow.

The tubes used in this clock are Russian (Soviet) military tubes. The Soviets, seeing the Western Nixie, came up with their own versions with similar sizes and shapes. Unlike the U.S. Tubes, they were manufactured well into the 1980's. Since the collapse of the Soviet Union, these tubes became available on the surplus market.

This clock contains the IN-8-2 series of tubes or the IN-14’s, which has a ‘5’ digit that is actually the ‘2’ digit upside down and reversed. Unlike the IN-14’s, the IN-8-2 tubes have a normal ‘5’ digit.

A note on tube life:

The tubes have a certain lifetime, but it is in the order of 100,000 - 200,000 hours. They do not have a filament like audio tubes. They are more like a neon light bulb. My circuitry is very conservative - well within the design limits of the tubes. They should last a long time. Also, you can program the clock to turn off the display at night, which will further increase the life of the tubes (the default settings turn the display off at 23:00, and back on at 6:00, it can be set to any value or on all the time).

All Cold War Creations clocks use tested tubes. Each tube has every digit burned in at a higher current to weed out weak tubes. Then the finished clock is run for at least 24 hours. Any tube that appears marginal or fails is replaced and retested.

This clock uses socket pins for the Nixie tubes. The pins allow tubes to be changed out without soldering, if they do fail. The pins are very small so as not to change the look of the clock.

3 Clock Features

The glass clock has many features. They are listed below:

- Unique look of individually formed digits with a neon orange glow.
- Rare IN-8-2 tubes (in some models) with a real '5' digit.
- Other models use the IN-14 tubes.
- Optically pure Simax brand glass (from the Czech Republic) tubes for the outer case and feet.
- Laser cut clear acrylic used for the case's internal support pieces.
- Time can be displayed in either 12 or 24-hour format, with or without leading zero blanking.
- Date can optionally be displayed in either "mm dd yy", "dd mm yy" or "yy mm dd" format.
- Auto Daylight savings time adjustment.
- Temperature can optionally be displayed in either Degrees F, or Degrees C.
- Power loss time backup (up to 12 hours), will not lose the time if power fails, and no battery to replace.
- Nixie tube anti-cathode protection software, helps prevent tube failure. Once a day, once an hour, or every 15 minutes. User selectable.
- Programmable display Off period – blanks display, while still keeping time. Auto shutoff option when ambient light is low. Also can be programmed to shut off the display during the weekend, or during weekdays.
- Temperature compensated Quartz Crystal controlled time base for accuracy.
- Automatic Leap Year correction.
- Auto display brightness settings.
- Options for special effects: cross fading digits, slot effect and sliding digits.
- Pin sockets for Nixie tubes – allowing easy change out of failed tubes.
- Alarm function and beep on the hour function.
- Optional Nixie tube floor lighting LEDs. Can be disabled at night.
- Optional GPS time sync module. This keeps the time synced all the time. Also, automatic Daylight Saving Time adjustment.
- Optional WiFi time sync module. This keeps the time synced all the time. Also, automatic Daylight Saving Time adjustment.

4 Unpacking and setting up the Clock

Carefully unpack the clock from the box. The box contains a wall plug-in power supply, the user manual and the clock itself.

The power supply plugs into the wall outlet. The other end plugs into the clock's power input jack.

When powered up for the first time, the clock will go through the self-test checkout. This checkout will beep 3 times (if the alarm option is present), set all the digits to '9', and each digit (starting with the leftmost digit) will count down from '9' to '0'. When this is complete the display will read "00 00 00". Then each digit will go blank one at a time starting with the leftmost digit. This completes the self-test.

If the optional GPS or WiFi module is installed and after the self test, '88 88 88' or '11 11 11' will be flashing on the display, indicating the clock is acquiring GPS/WiFi signal, see supplemental GPS/WiFi manual for more information.

The clock has two control buttons. On the left end is a function button, and on the right end is a mode button.

At this point, the clock should show "0:00" with the leftmost digits (hours) blinking. It is now in the time/date set mode. There is no need to press the right mode button to enter the time set mode. Go to the next section, "Setting the clock". Note: Due to the time save function of the clock, if it was disconnected from power less than 8 hours ago, it will not enter the time set mode – it will show the current time.

The GPS/WiFi option will automatically set the time, skipping the time/date set mode. See the GPS/WiFi supplemental manual for details.

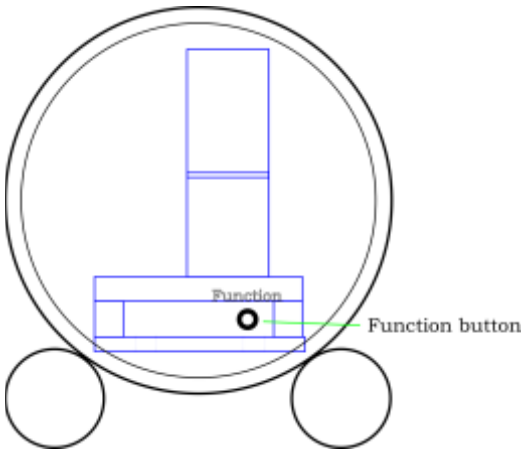


Illustration 1: Side View, Left

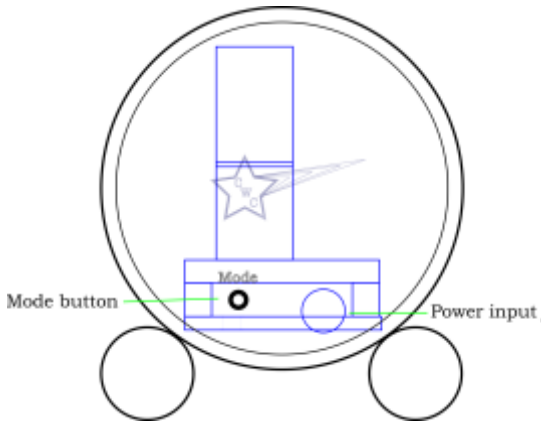


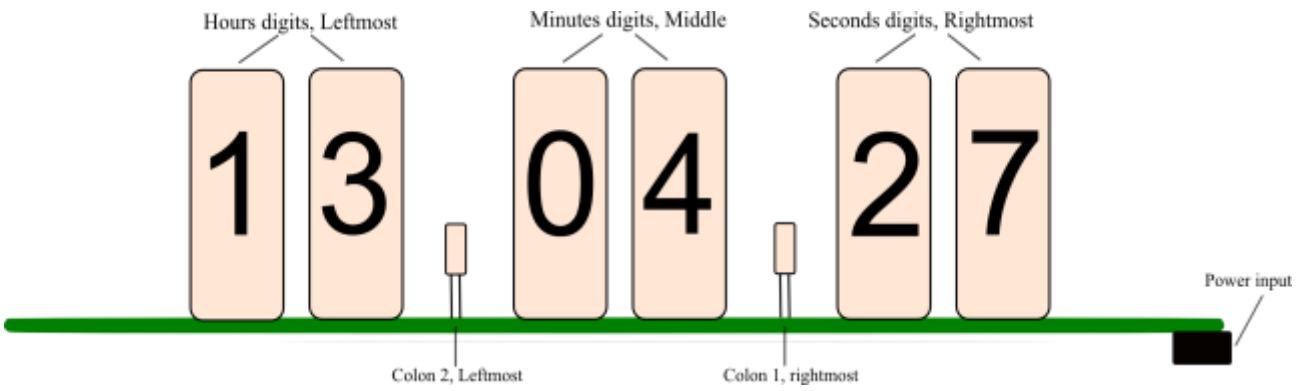
Illustration 2: Side View, Right

5 Setting the Clock

This section describes how to set the clock. This includes setting the time and date, plus all the display options. Setting the Nixie clock features is accomplished by using the mode button (right side) and the function button (left side).

Clock diagram

Illustration 3: Side view



Setting the time and date

When setting the time/date, the time is entered first followed by the date. Set the time by pressing the mode button on the right side momentarily (Note: when powered up the clock will already be in set time mode, no need to push the mode button). When pressed, the hour's digits will flash on and off once a second "00:00". Note: If the mode button is held too long, the display will blank, indicating that the clock is in the "set on/off time" mode. Press and hold the mode button until the display goes blank if this happens and try again.

The optional GPS/WiFi module will automatically set the time when the clock powers up, and then every 5 minutes resync the clock. If the GPS module loses satellite communications (or WiFi loses signal), the clock will continue to display the correct time and date. See the GPS/WiFi supplemental manual for more details.

Set time mode

When the clock is in the set time mode, the current time will be displayed with the hours (2 leftmost digits) blinking “00:00”. The left most colon will be on steady (no blinking) and the seconds will be off.

If the colons are blinking, the clock is still in the normal display mode, and the mode button on the right side should be momentarily pressed to enter the set time mode.

Note: If the clock loses time (first setup, or without power for an extended period of time) the time displayed will be all zeroes: 0:00.

To skip setting the time and go directly to setting the date, momentarily press the mode button to skip the time set functions.

To cancel setting the time value at any point, press and hold the mode button until the display goes blank. This will cancel setting the time/date. When the mode button is released, the clock will go back to the normal display. The old time value will be used.

Note: with the GPS/WiFi option, the time/date may be manually set, but will revert to the time from the GPS/WiFi next time the clock syncs with the GPS/WiFi module. The correct time is determined by the timezone offset (in board options) and the daylight saving time settings (in options settings).

5.1.1 Setting the time - hours

When the hours (leftmost) digits are blinking, the hour value can be changed. Note: If changing only the hours, the clock will continue to count seconds, for precise time value.

The function button on the left side will change the hour value when pressed. Holding the function button on will quickly cycle through the hours (0-23). Note: When setting the hours, 24 hour mode is used, regardless of the hour format setting (12/24 hour display mode). This means '00' is 12 AM (midnight), and '13' is 1 PM (afternoon). The hour format setting will be used when displaying the time normally.

Once the hours are set to the proper value, press the mode button (right side) momentarily. The clock will then go to the minutes set mode.

5.1.2 Setting the time – minutes

When the minutes (middle) digits are blinking, the minutes value can be changed.

The function button (left side) will change the minute value when pressed. Holding the function button on will quickly cycle through the minutes (0-59).

After the minutes are set correctly, momentarily press the mode button (right side). At this point, all the digits (Hours:Minutes:Seconds) will flash once a second. Pressing the mode button again will update the time to the new settings. Note: The seconds value will be reset to '00' when the time is set.

Now that the time is set, the clock will go to the set date mode.

5.1.3 Setting the time – change hours for manual Daylight Savings

If not using the auto Daylight Saving time setting, when changing manually changing the hours, only the hours need to be changed, the minutes and seconds will stay the same. Seconds will continue to count up while setting the hours. Auto Daylight Saving is also available for both the GPS/WiFi option.

When the hours (leftmost) digits are blinking, the hour value can be changed.

The function button on the left side will change the hour value when pressed. Holding the function button on will quickly cycle through the hours (0-23). Note: When setting the hours, 24 hour mode is used, regardless of the hour format setting (12/24 hour display mode). This means '00' is 12 AM (midnight), and '13' is 1 PM (afternoon). The hour format setting will be used when displaying the time normally.

Once the hours are set to the proper value, press the mode button (right side) momentarily. The clock will then blink the minutes. Press and hold the mode button until the display goes blank. Let go of the mode button.

Now that the time is set, the clock will go to the set date mode. Press and hold the mode button until the display goes blank. Let go of the mode button.

The time is now changed, and the display will go back to normal time display. Only the hours were changed, the minutes and seconds are unchanged, and seconds continued to count.

Also an available function to automatically adjust the time for Daylight Saving Time, see the Options section. Will change the hour +1 or -1 depending on the time of year. Available in USA-Canada, Europe, New Zealand or Australian DST zones. This also will work in optional GPS sync mode. See clock options section.

Set date mode

When the clock is in the set date mode, the current date will be displayed with the days (2 leftmost digits) blinking. The colons will both be off.

The clock will automatically compensate for leap year.

If not in the date set mode, see the “Setting the time and date” section. Before the date can be set, the time must be set. Note: If only the date needs to be set, enter time set mode, and momentarily press the mode button to go through the hours, minutes until the date mode appears. The time will not change.

To cancel setting the date value at any point, press and hold the mode button until the display goes blank. This will cancel setting the date. When the mode button is released, the clock will go back to the normal display. The old date value will be used.

5.1.4 Setting the date – month

At this point, the month number (digits selected depend on date format) will be blinking. Use the function button to change the month value ('01' = January, '12' = December, etc).

Once the month value is set to the proper value, press the mode button momentarily. The clock will then go to the day set mode.

5.1.5 Setting the date – day

At this point, the day number (digits selected depend on date format) will be blinking. Use the function button (left side) to change the day value (01 – 31).

Once the day value is set to the proper value, press the mode button momentarily. The clock will then go to the year set mode.

5.1.6 Setting the date - year

At this point, the year number (digits selected depend on date format) will be blinking. Use the function button to change the year value ('10' = 2010, '99' = 2099, etc).

Once the year value is set to the proper value, press the mode button (right side) momentarily. At this point the date is set and the clock will go back to the normal display mode.

Changing clock options

There are several clock and display options available that can be changed by the user. When changed, these options will be saved to permanent memory. They will be saved even if the power is off for an extended period of time.

Enter the options mode by pressing and holding the function button (left side) until the display goes blank. Then release the function button. The 2 leftmost digits will flash with '12', '24', '01', or '02' value, (indicating option 1). Each option is displayed one after another (by pressing the mode button), starting with option 1 and ending with option 10.

To exit clock options mode, press and hold the mode button until the display goes blank. Then release the mode button. Clock will then go back to normal time display mode.

Table of clock options

Option 1	12/24 hour mode, leading zero blanking
Option 2	Date format option: mm-dd-yy, dd-mm-yy or yy-mm-dd, Auto DST adjust
Option 3	Display option, time/date/temperature, digit special effects
Option 4	Temperature units, F or C
Option 5	Brightness level, auto or fixed brightness
Option 6	Anti-cathode poisoning mode start time
Option 7	Colon display options
Option 8	Optional Floor LED lighting options
Option 9	Optional GPS/WiFi mode options
Option 10	Beep on the hour options

5.1.7 Option 1 – 12/24 hour mode

Display: “12 : □□ □□”, left most colon ON

This option selects the hour style displayed:

- 12 hour style is 1:00 → 12:00 AM/PM (default). Leading zero on hours blanked. Displays “12 □□ □□”.
- 24 hour style is 0:00 → 23:00. Leading zero on hours blanked. Displays “24 □□ □□”.
- Leading zero 12 hour style is 1:00 → 12:00 AM/PM (default). Leading zero on hours displayed, example: 1 AM would be ’01 00 00’. Displays “01 □□ □□”.
- Leading zero 24 hour style is 0:00 → 23:00. Leading zero on hours displayed, example: 1 AM would be ’01 00 00’. Displays “02 □□ □□”.

A blinking '12', '24', ‘01’, ot ‘02’ will be displayed in the 2 leftmost digits, indicating the hour style. To change the style, press the function button (left side). Press the mode button (right side) when the desired hour style is displayed. Then the next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation, aborting setting option 1.

5.1.8 Option 2 – Date format display option

Display: "□□ : 01 □□", left most colon ON

This option selects the date format displayed. Also Auto Daylight Saving Time adjustment can be selected. There are 12 different date display/Auto DST formats available (note: Auto DST also works with the GPS/WiFi option):

- '01' = display date format: mm dd yy (default). No DST adjust.
- '02' = display date format: dd mm yy. No DST adjust.
- '03' = display date format: yy mm dd. No DST adjust.
- '11' = display date format: mm dd yy (default). USA auto DST adjust.
- '12' = display date format: dd mm yy. USA auto DST adjust.
- '13' = display date format: yy mm dd. USA auto DST adjust.
- '21' = display date format: mm dd yy (default). EU auto DST adjust.
- '22' = display date format: dd mm yy. EU auto DST adjust.
- '23' = display date format: yy mm dd. EU auto DST adjust.
- '31' = display date format: mm dd yy (default). Australia auto DST adjust.
- '32' = display date format: dd mm yy. Australia auto DST adjust.
- '33' = display date format: yy mm dd. Australia auto DST adjust.
- '41' = display date format: mm dd yy (default). New Zealand auto DST adjust.
- '42' = display date format: dd mm yy. New Zealand auto DST adjust.
- '43' = display date format: yy mm dd. New Zealand auto DST adjust.

A blinking '01' → '43' will be displayed in the 2 middle digits, indicating the selected date display format. To change the format, press the function button (left side). Press the mode button (right side) when the desired display format is shown. Then the next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 will still be saved, but option 2 will not be saved.

USA DST auto adjust:

When enabled, will adjust the hour for DST adjustment as follows:

- Ahead 1 hour the 2nd Sunday in March.
- Back 1 hour the 1st Sunday in November.
- Note: time changes at 2 AM.

EU DST auto adjust:

When enabled, will adjust the hour for DST adjustment as follows:

- Ahead 1 hour the last Sunday in March.
- Back 1 hour the last Sunday in October.
- Note: time changes at 2 AM.

Australian DST auto adjust

When enabled, will adjust the hour for DST adjustment as follows:

- Ahead 1 hour the 1st Sunday in October.
- Back 1 hour the 1st Sunday in April.
- Note: time changes at 2 AM.

New Zealand DST auto adjust

When enabled, will adjust the hour for DST adjustment as follows:

- Ahead 1 hour the last Sunday in September.
- Back 1 hour the 1st Sunday in April.
- Note: time changes at 2 AM.

5.1.9 Option 3 – Display options, Special effects

Display: "□□ : □□ 13", left most colon ON

There are 3 different display styles available; the following code numbers are used:

- '00' = display time only. No special effects.
- '01' = display time and date. No special effects.
- '02' = display time and temperature. No special effects.
- '03' = display time, date and temperature. No special effects.
- '10' = display time only with digit crossfade.
- '11' = display time and date with digit crossfade.
- '12' = display time and temperature with digit crossfade.
- '13' = display time, date and temperature with digit crossfade (default).
- '20' = display time only with digit slot effect.
- '21' = display time and date with digit slot effect.
- '22' = display time and temperature with digit slot effect.
- '23' = display time, date and temperature with digit slot effect.
- '31' = display time and date with digit slide across and crossfade.
- '32' = display time and temperature with digit slide across and crossfade.
- '33' = display time, date and temperature with digit slide across and crossfade.

Time is displayed HH:MM:SS (HH = hours, MM = minutes, SS = seconds) with blinking colons between the digits.

Date is displayed MM:DD:YY (MM = Month, DD = day, YY = year), or DD:MM:YY or YY:MM:DD.

Temperature is displayed TT (TT = temperature, Deg C or Deg F, see option 4).

The time will display for 16 seconds, followed by the date (if enabled) for 3 seconds, followed by the temperature (if enabled) for 3 seconds, then back to the time display. These times can be changed in Board Options.

The Crossfade style option is when a digit changes value (seconds counting up, etc) the old digit fades out while at the same time the new digit fades in. This is a user preference, and other than changing the look of the digits as they change, has no other effect.

The Slot effect option is when a digit changes value (seconds counting up, etc) the old digit rapidly cycles different digits until it reads the new value, looking something like a slot machine. This is a user preference, and other than changing the look of the digits as they change, has no other effect.

The Slide Across style option is when a switching to a different display value (time/date/temperature). The old digits “slide” off the display on the right side and the new digits slide in from the left side. This is a user preference, and other than changing the look of the digits as they change, has no other effect.

A blinking '00' → '03', '10' → '13', '20' → '23', '31' → '33' will be displayed in the 2 rightmost digits, indicating the selected display style. To change the style, press the function button (left side). Press the mode button (right side) when the desired display style is shown. The next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 & 2 will still be saved, but option 3 will not be saved.

5.1.10 Option 4 – Temperature units, F or C

Display: “01 ☐☐ : ☐☐”, right most colon ON

This option selects the temperature units displayed:

- '00' format is Degrees Celsius.
- '01' format is Degrees Fahrenheit (default).

A blinking '00' or '01' will be displayed in the 2 leftmost digits, with the colon on. To change the temperature display format, press the function button (left side). Press the mode button (right side) when the desired hour format is displayed. The next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1, 2 & 3 will still be saved, but option 4 will not be saved.

5.1.11 Option 5 – Brightness level, Weekend OFF

Display: "□□ 00 : □□", right most colon ON

This option selects the brightness level for the display. There are 5 brightness levels to select. Four are fixed, and the other is auto brightness (depends on ambient light value) as follows:

- '01' = dim, no colons
- '02' = low-medium
- '03' = medium
- '04' = brightest level
- '00' = Auto brightness level (default). When this level is selected, a light sensor on the clock will automatically set the display brightness level, depending on the ambient light level.
- '09' = Auto brightness level/ Auto ON-OFF. When this level is selected, a light sensor on the clock will automatically set the display brightness level (like mode 00), depending on the ambient light level. Additionally, the clock display will turn off when the ambient light level is low (dark), and turn on when the light level is bright. If the display ON/OFF setting is used in conjunction with Auto ON/OFF, the display will be ON during the ON time, regardless of ambient light level. During the OFF time, auto display ON/OFF function will control the display.
- OPTIONS 10 -19 turn off the display during the weekend (Saturday and Sunday), regardless of other settings.
- '11' = dim, no colons, display off during weekend.
- '12' = low-medium, display off during weekend.
- '13' = medium, display off during weekend.
- '14' = brightest level, display off during weekend.
- '10' = Auto brightness level, display off during weekend.
- '19' = Auto brightness level/ Auto ON-OFF. When this level is selected, a light sensor on the clock will automatically set the display brightness level (like mode 00), depending on the ambient light level. Additionally, the clock display will turn off when the ambient light level is low (dark), and turn on when the light level is bright. Display will be off during the weekend.

- OPTIONS 20 -29 turn off the display during the weekdays (Monday – Friday).
- '21' = dim, no colons, display off during weekdays.
- '22' = low-medium, display off during weekdays.
- '23' = medium, display off during weekdays.
- '24' = brightest level, display off during weekdays.
- '20' = Auto brightness level, display off during weekdays.
- '29' = Auto brightness level/ Auto ON-OFF. When this level is selected, a light sensor on the clock will automatically set the display brightness level (like mode 00), depending on the ambient light level. Additionally, the clock display will turn off when the ambient light level is low (dark), and turn on when the light level is bright. Display will be off during the weekdays.

  Note: When the clock is in the dim level, either manually selected or selected by the auto level(s), the blinking colons will not be displayed on the time display.

A blinking '00' → '04', ‘09’, '10' → '14', ‘19’, '20' → '24', ‘29’ will be displayed in the 2 middle digits, with the colon on. To change the brightness level, press the function button (left side). Press the mode button (right side) when the desired brightness level is displayed. The next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 - 4 will still be saved, but option 5 will not be saved.

5.1.12 Option 6 – Anti-cathode poisoning function

Display: “☐☐ ☐☐ : 02” , right most colon ON

This option selects the anti-cathode poisoning function. This option will enable/disable anti-cathode poisoning function for the display.

- '00' = disable anti-cathode poisoning function.
- '01' → '23' = selects which hour anti-cathode poisoning starts (once a day).
- '44' = selects an hourly anti-cathode poisoning, at :01 minutes past the hour.
- ‘55’ = selects anti-cathode poisoning every 15 minutes, at :00, :15, :30, and :45 minute mark.
- ‘03’ is the default value (3 am).

Anti-cathode poisoning mode helps prevent a condition in Nixie tubes where the cathodes (the individual digits) that aren't used often will be 'poisoned'. This is where deposits build up on the digits. When these deposits are thick enough, parts of the digit will not light up. This mode will cycle all the tubes through all the digits at full brightness 4 times, exercising the digits, preventing cathode poisoning.

A blinking '00' → '23', ‘44’, ‘55’ will be displayed in the 2 rightmost digits, with the colon on. To change the enable time, press the function button (left side). Holding the function button on will quickly cycle through the hours (0-23, 44, 55). Press the mode button when the desired anti-cathode poisoning enable time is displayed. The next option will be displayed.

To cancel the option function, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 - 5 will still be saved, but option 6 will not be saved.

5.1.13 Option 7 – Colon Display Options

Display: "02 : □□ : □□", both colons ON

This option selects the colon display mode. This controls the colons during time display. Date, temperature and settings displays have a fixed function for the colons.

- '00' = disable displaying colons. Colons off for time display.
- '01' = Colons on (no blinking) for time display.
- '02' = blinking colons. Colons blink once a second for time display.
- '03' = alternating blinking colons. Colons blink (one colon off, the other on) once a second for time display.

A blinking '00' → '03' will be displayed in the 2 leftmost digits, with the colons on. To change the enable time, press the function button (left side). Holding the function button on will quickly cycle through the modes (0-03). Press the mode button when the desired colon mode is displayed. The next option will be displayed.

To cancel the option function, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 - 6 will still be saved, but option 7 will not be saved.

5.1.14 Option 8 – Floor LED Options

Display: "☐☐ : 00 : ☐☐", both colons ON

This option selects the optional floor LED lighting options. Floor LEDs are LED's below each Nixie tube, and add a lighting effect to the tubes. Modes 11 – 13 will shutoff the floor LEDs if the ambient lighting is low.

- '00' = disables the Floor LEDs. If the Floor LED option is not on the clock, this is the only option that is selectable.
- '01' = Floor LEDs on maximum brightness when the display is on, when the display is off so are the floor Leds.
- '02' = Floor LEDs on auto brightness when the display is on, when the display is off so are the floor Leds. Auto brightness adjusts the floor LED brightness with the ambient lighting.
- '03' = Floor LEDs on minimum brightness when the display is on, when the display is off so are the floor Leds.
- '11' = Floor LEDs on maximum brightness when the display is on, when the display is off so are the floor Leds. Also, when it is dark, the floor LEDs will turn off (Nixie's may still be on). See Board Options for light level setting to turn off LEDs.
- '12' = Floor LEDs on auto brightness when the display is on, when the display is off so are the floor Leds. Auto brightness adjusts the floor LED brightness with the ambient lighting. Also, when it is dark, the floor LEDs will turn off (Nixie's may still be on). See Board Options for light level setting to turn off LEDs.
- '13' = Floor LEDs on minimum brightness when the display is on, when the display is off so are the floor Leds. Also, when it is dark, the floor LEDs will turn off (Nixie's may still be on). See Board Options for light level setting to turn off LEDs.

A blinking '00' → '03' or '11' → '13' will be displayed in the 2 leftmost digits, with the colons on. To change the enable time, press the function button (left side). Holding the function button on will quickly cycle through the modes (0-03, 11-13). Press the mode button when the desired floor LED mode is displayed. The next option will be displayed.

To cancel the option function, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 - 7 will still be saved, but option 8 will not be saved.

5.1.15 Option 9 – Optional GPS/WiFi mode options

Display: “☐☐ : ☐☐ : 00”, both colons ON

This option selects GPS/WiFi sync mode. Note: If this option is not included with the clock, the only mode available is the GPS/WiFi option disabled.

- '00' = disables the GPS/WiFi time sync. If the GPS/WiFi option is not on the clock, this is the only option that is selectable. When disabled, the GPS module will turn off if present.
- '01' = GPS/WiFi time sync enabled. Time will automatically sync when the clock powers up, and also every 5 minutes. If GPS/WiFi loses sync, the colons will alternate blinking. For more information, see the supplemental GPS/WiFi manual.
- ‘02’ = GPS/WiFi Auto detect enabled. This will auto detect a GPS module or WiFi module whenever the clock restarts (indicated by the display self-test). If detected, the clock will update the time based on the GPS/WiFi.

A blinking '00', ‘01’ or '02' will be displayed in the 2 right most digits, with both colons on. To change the GPS/WiFi option, press the function button (left side). Press the mode button (right side) when the desired GPS/WiFi option is displayed. The next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 - 8 will still be saved, but option 9 will not be saved.

5.1.16 Option 10 – Beep on Time value

Display: "01 : ☐☐ : ☐☐", both colons OFF

This option selects Beep tone on the hour or every ½ hour or every 15 minutes. Note: If the alarm option is not on the clock, this function will not work.

- '00' = disables the beep function. No tone at anytime.
- '01' = Beep on the hour enabled. When the clock reaches the top of the hour (minutes = 0), the clock will beep twice.
- '02' = Beep on the hour and ½ hour enabled. When the clock reaches the top of the hour (minutes = 0), the clock will beep twice. When the clock reaches the ½ hour (minutes = 30) the clock will beep once.
- '03' = Beep on the hour and every 15 minutes enabled. When the clock reaches the top of the hour (minutes = 0), the clock will beep twice. When the clock reaches 15 minutes (minute = 15), ½ hour (minutes = 30) and 45 minutes (minute = 45) the clock will beep once.
- When the alarm is active, the clock will not beep. However, if the alarm is snoozing, it will beep.

A blinking '00', '01', '02' or '03' will be displayed in the 2 left most digits, with both colons off. To change the beep option, press the function button (left side). Press the mode button (right side) when the desired beep option is displayed. The next option will be displayed.

To cancel the option mode, press and hold the mode button until the display goes blank. Release the mode button and the clock will go back to normal operation. Option 1 – 9 will still be saved, but option 10 will not be saved.

Setting the display ON/OFF times

The clock display can be programmed to turn off and on at a specified time. Turning the digits off at night can extend the life of the tubes, or it may be desired to have the clock dark at night. The OFF time setting is the hours: minute when the display will turn off. The ON time setting is the hours: minute when the display will turn back on. Note: When the display is off, and either the mode button or the function button is momentarily pressed, the display will go back on for 1 ½ minutes.

If auto ON/OFF option (‘9’, ‘19’, ‘29’ for display brightness option) is selected, the display will be ON during the ON time, regardless of ambient light level. During the OFF time, auto display light level ON/OFF will control the display. See Section ‘Option 5 – Brightness level’. If OFF/ON time is disabled (ON and OFF time set to the same time), Auto ON/OFF will be enabled all the time.

OFF/ON mode is disabled if the hour time setting for both OFF and ON are set to the same value. Example: OFF time = 12:01, ON time = 12:45, OFF/ON mode disabled.

Note: Default setting is display OFF at 23:00, and display ON at 6:00.

The clock may be programmed to turn off the display for the entire weekend (or weekdays), see Option 5, brightness level.

5.1.17 Entering the OFF/ON set time enable

Enter the OFF/ON set time enable by pressing and holding the mode button until the display goes blank. When the display is blank, release the mode button. At this point the display will show blinking hour digits and the minutes digits for the OFF time. The clock will now be in the Set OFF/ON times mode, which is indicated by the current OFF time (initially zero hours, zero minutes), and the leftmost colon on. Seconds digits will be blank.

5.1.18 Setting the OFF time

The OFF time setting is indicated by the leftmost colon on.

Setting the display OFF time is accomplished by using both the mode button and the function button.

The hours digits will be flashing on and off once a second. The function button will change the hour value. Holding the function button on will quickly cycle through the hours (0-23). Note: When setting the hours, 24 hour mode is used, regardless of the hour format setting (12/24 hour display mode). This means '00' is 12 AM (midnight), and '13' is 1 PM (afternoon).

Once the hours are set correctly, press the mode button to change to the minute value. When the mode button is momentarily pressed, the minutes digits will flash on and off once a second. The function button will change the minute value. Holding the function button on will quickly cycle through the minutes (0-59).

After the minutes are set correctly, momentarily press the mode button. At this point, the OFF time setting is complete, and will now show the ON time setting (ON time hours digits are flashing).

To cancel setting the OFF time value at any point, press and hold the mode button until the display goes blank. This will cancel setting the OFF time. When the mode button is released, the clock will go back to the normal display.

Note: When the clock is in Auto ON/OFF mode, the display will only be off when the light level is dark.

After the OFF time is set, the ON time is set next.

5.1.19 Setting the ON time

The ON time setting is indicated by the rightmost colon on.

Setting the display ON time is accomplished by using both the mode button and the function button.

The hours digits will be flashing on and off once a second, and the minutes digits will be on steady. The function button (left side) will change the hour value. Holding the function button on will quickly cycle through the hours (0-23). Note: When setting the hours, 24 hour mode is used, regardless of the hour format setting (12/24 hour display mode). This means '00' is 12 AM (midnight), and '13' is 1 PM (afternoon).

Once the hours are set correctly, press the mode button (right side) to change to the minute value. When the mode button is momentarily pressed, the minutes digits will flash on and off once a second. The function button will change the minute value. Holding the function button on will quickly cycle through the minutes (0-59).

After the minutes are set correctly, momentarily press the mode button. At this point, the ON time setting is complete, and will now go back to normal time display.

To cancel setting the ON time value at any point, press and hold the mode button until the display goes blank. This will cancel setting the ON time. When the mode button is released, the clock will go back to the normal display.

After the ON time is set, the clock will go back to normal time display.

5.1.20 Disabling OFF/ON time

The display OFF function can be disabled by setting both the OFF and ON time to the same hour value, such as 00:00 for OFF and 00:00 for ON. This will disable the OFF mode.

Note: In Auto ON/OFF mode, when the display ON/OFF is disabled, the ambient light will control whether the display is ON or OFF.

5.1.21 Examples for setting OFF/ON time

Example one, set clock display to go off at 11 PM, and back on at 6 AM:

1) Push and hold the mode button until the display goes blank. When the display is blank, release mode button.
2) OFF time hours digits will be blinking. Press function button until hours digit shows 23 (11 PM). Momentarily press mode button – minute digits will start to blink.
3) Press function button until OFF minute digits show 00.
4) Momentarily press mode button, ON hours digits will blink. Press function button until hours digit shows 6 (6 AM). Momentarily press mode button – minute digits will start to blink.
5) Press function button until ON minute digits show 00.
6) Press mode button to exit OFF/ON time set mode.

Example two, disable OFF/ON time setting:

1) Push and hold the mode button until the display goes blank. When the display is blank, release mode button.
2) OFF time hours digits will be blinking. Press function button until hours digit shows 00. Momentarily press mode button – minute digits will start to blink.
3) Press function button until OFF minute digits show 00.
4) Momentarily press mode button, ON hours digits will blink. Press function button until hours digit shows 00. Momentarily press mode button – minute digits will start to blink.
5) Press function button until ON minute digits show 00.
6) Press mode button to exit OFF/ON time set mode. OFF/ON mode is disabled.

Alarm Function

The clock has an optional Alarm Function. The alarm is a tone that beeps once a second while the clock is in alarm.

The alarm also has a snooze function, enabled by momentarily pushing either the function or mode buttons. The alarm can also enter snooze mode by simply turning on a light (the clock senses a sudden increase in light, which will trigger snooze mode).

The alarm can also be set to only alarm during a weekday, with no alarms during the weekend.

If the alarm option is present, there is also a beep twice on the hour function (and also every ½ hour or every 15 minutes if desired) see option 10.

5.1.22 Setting up the Alarm function

The Alarm setup function is entered by momentarily pressing the function button. The clock will beep once and display 2 digits in the minutes position.

Note: If the Alarm Function is not present in the clock, this menu function will not be enabled.

The minutes digits will be flashing on and off once a second. The function button (left side) will change the alarm setup value. The mode button will exit the Alarm setup function.

- '00' = Disables the Alarm. If selected, this will disable the alarm, and exit the Alarm setup function.
- '01' = Alarm on when alarm time is reached. Snooze mode enabled.
- '02' = Alarm on when alarm time is reached. Snooze mode enabled, alarm will snooze when ambient light increases (a light is turned on, etc).
- '03' = Alarm on when alarm time is reached. Alarm will only go on once, no snooze function.
- '04' = Alarm on when alarm time is reached. Alarm will only go on once, no snooze function. Alarm disabled when ambient light increases.
- '11' = Alarm on when alarm time is reached. Snooze mode enabled. Alarms only during a weekday.
- '12' = Alarm on when alarm time is reached. Snooze mode enabled, alarm will snooze when ambient light increases (a light is turned on, etc). Alarms only during a weekday.
- '13' = Alarm on when alarm time is reached. Alarm will only go on once, no snooze function. Alarms only during a weekday.
- '14' = Alarm on when alarm time is reached. Alarm will only go on once, no snooze function. Alarm disabled when ambient light increases. Alarms only during a weekday.

After the Alarm function is set correctly, momentarily press the mode button. At this point, the Alarm function setting is complete, and will now go to either the alarm time setup or back to normal time display.

5.1.23 Setting the Alarm time

After the Alarm function is set correctly, momentarily press the mode button. At this point, the Alarm function setting is complete, and will now go to either the alarm time setup or back to normal time display.

When an alarm function of '01' → '14' is selected, the alarm time will be displayed and can be changed. If the alarm is disabled (by selecting alarm function '00'), the clock will return to normal time display mode.

Setting the alarm – hours

When the hours (leftmost) digits are blinking, the hour value can be changed.

The function button on the left side will change the hour value when pressed. Holding the function button on will quickly cycle through the hours (0-23). Note: When setting the hours, 24 hour mode is used, regardless of the hour format setting (12/24 hour display mode). This means '00' is 12 AM (midnight), and '13' is 1 PM (afternoon).

Once the hours are set to the proper value, press the mode button (right side) momentarily. The clock will then go to the minutes set mode.

Setting the alarm – minutes

When the minutes (middle) digits are blinking, the minutes value can be changed.

The function button (left side) will change the minute value when pressed. Holding the function button on will quickly cycle through the minutes (0-59).

After the minutes are set correctly, momentarily press the mode button (right side). At this point, all the digits (Hours:Minutes:Seconds) will flash once a second. Pressing the mode button again will update the time to the new settings. Note: The seconds value will be reset to '00' when the time is set.

Now that the alarm time is set, the clock will go normal time display mode.

5.1.24 Alarm Snooze mode

The alarm also has a snooze function, provided Alarm Function ‘01’ or ‘11’ is selected.

The alarm starts when the clock time is equal to the alarm time. The clock will continue to sound the alarm for the entire alarm period (this time can be changed in the board options).

When either the mode or function button is momentarily pressed, the alarm will silence, and wait the snooze period (this time period can be changed in the board options, 1 to 59 minutes). Then the alarm will sound again. This will continue until the alarm time period (this time period can also be changed in the board options, 2 – 127 minutes) is complete.

To cancel the alarm completely, press and hold the mode button until the alarm is silenced. Also, if the alarm function is set to ‘00’, the alarm will also be canceled.

5.1.25 Alarm Light Sensor Snooze Mode

The alarm also has a light sensor snooze function, provided Alarm Function ‘02’ or ‘12’ is selected.

This function works as follows: When the alarm is activated, the clock reads the current ambient light level. During the alarm, if the light level increases a set amount or more, the alarm will go into snooze mode for 1 minute. At the end of the snooze period, the alarm will go off if the light level drops below the saved light level. If the light stays brighter, the alarm will stay silent. This continues until the alarm period is over.

In other words, the alarm tone will be silenced by turning on the room light. If the light is turned back off, the alarm will sound again. After the end of the alarm period, the alarm will stay silenced.

To cancel the alarm completely, press and hold the mode button until the alarm is silenced. Also, if the alarm function is set to ‘00’, the alarm will also be canceled.

5.1.26 Alarm Once mode

The alarm also be activated only once (no snooze), provided Alarm Function ‘03’, ‘04’, ‘13’, or ‘14’ is selected.

The alarm starts when the clock time is equal to the alarm time. The clock will continue to sound the alarm for the entire alarm period (this time can

be changed in the board options).

When either the mode or function button is momentarily pressed, the alarm will silence, and not activate again (until the next day). When function ‘04’ or ‘14’ is selected, turning on a room light will also silence the alarm.

To cancel the alarm completely, press and hold the mode button until the alarm is silenced. Also, if the alarm function is set to ‘00’, the alarm will also be canceled.

5.1.27 Alarm Weekend off mode

The alarm can also be set to not alarm on the weekend (only during the weekend) provided Alarm Function ’11, ‘12’, ‘13’ or ‘14’ is selected.

Note: other than the no alarm on the weekend feature, alarm ‘11’ is the same as function ‘01’, alarm ‘12’ is the same as ‘02’, ‘13’ is the same as function ‘03’ and ‘14’ is the same as alarm function ‘04’.

5.1.28 Alarm function when there is a power loss

When a clock power loss occurs, and the alarm is active (meaning clock is beeping during an alarm, or alarm snoozing), the alarm will silence, display will go off, but the clock will still keep track of the time.

When power is restored the following actions are taking for the alarm:

1. If the clock time is out of the alarm period (see board options for setting the alarm period length), the clock will not sound the alarm.
2. If the clock time is in the alarm period, the clock will alarm 1 minute following the time the clock receives power. All the snooze functions will still work.
3. If the clock was snoozing in the alarm mode when power was lost, the clock will alarm 1 minute following the time the clock receives power. All the snooze functions will still work.

5.1.29 New Year's Eve display

During New Year's Eve, the clock has a special display to mark to New Year.

At 11:50 PM New Year's Eve, the clock display will turn on if it is disabled (it will stay on if it is not). If the clock is on Auto brightness, it will still control the display brightness.

At 11:59 PM to 12:00 AM, the display will blink, indicating the end of the current year. The clock will also beep 4 times at 11:59.

At 12:01 AM the display will stop blinking.

At 12:05 AM the display will return to normal. If it was programmed to be off at this time, the display will go off.

To cancel the blinking digits, press either the mode or function button, and the New Year's display will be cancelled.

6 Board Options

The Board Options control clock board parameters. Normally, these options should not be changed. However, several user customization options are defined for the clock.

Changing clock board options

There are several clock and system options available that can be changed by the user. When changed, these options will be saved to permanent memory. They will be saved even if the power is off for an extended period of time.

Enter the board options mode by pressing and holding the function button (left side) until the display goes blank. Keep pressing the function button, and then momentarily press the mode button until the colons alternate blinking (left on/right off, left off/right on, etc). Release both buttons.

After releasing both buttons, the colons will continue alternating blinking, and the display will show the board's serial number in the 4 right most digits.

Momentarily pressing the mode button will go to the next option. When the mode button is pressed at the last option, it will go back to option 0 (serial number).

Pressing and holding the mode button will exit the clock board options mode.

Table of clock board options

Option 0	Board serial number
Option 1	Temperature offset value
Option 2	Auto off light level set point value
Option 3	Light sensor zero offset value
Option 4	Time display interval set point value
Option 5	Temp/date display interval set point value
Option 6	Alarm duration set point value (optional)
Option 7	Alarm Snooze set point value (optional)
Option 8	Time offset value
Option 9	Floor LED off light level set point value
Option 10	GPS/WiFi timezone offset value
Option 11	Light offset alarm snooze value

6.1.1 Board Option 0 – Serial number

Display: “ ☐☐ ☐☐”, colons alternating

This option shows the clock’s serial number. It is a number from 0001 – 9999. It is a read only value, can not be changed.

Momentarily press the mode button to go to the next option.

To exit clock board options mode, press and hold the mode button until the display is blank. Release the mode button and the clock will go back to normal mode.

6.1.2 Board Option 1 – Temperature offset value

Display: “01 ☐☐ ☐☐”, ‘01’ blinking.

This option changes the temperature probe offset value.

- The temperature is calibrated at the factory, but may be changed by the user. This calibration offset is in degrees C.
- The value is an offset * 10. Examples: a -10 will reduce the displayed temperature by 1 degree C. A 25 will increase the displayed temperature by 2 ½ degrees C.
- The offset range is -950 to +950 (-95 DegC to +95 DegC).
- Negative value is indicated by the left most colon ON.

A blinking '01' will be displayed in the 2 leftmost digits, indicating Option 1, temperature offset value. To change the offset value, momentarily press the function button (left side). This enters change value mode, the ‘01’ will stop blinking.

Change the current value by pressing the function button. For a negative number, the left most colon will be on, for a positive number, the left most colon will be off. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.3 Board Option 2 – Auto Off Light Level value

Display: “02 ☐☐ ☐☐” , ‘02’ blinking.

This option changes the Auto Off light level value.

- This is the level that turns off the display.
- The value range is 4 to 25, 4 is the lowest level, 25 is the highest. Set to lower number to trigger OFF at a darker ambient light level.

A blinking '02' will be displayed in the 2 leftmost digits, indicating Option 2, Auto off light level value. To change the level value, momentarily press the function button (left side). This enters change value mode, the ‘02’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.4 Board Option 3 – Light sensor zero offset value

Display: “03 ☐☐ ☐☐” , ‘03’ blinking.

This option changes the Light Sensor zero offset display value.

- This is the level that scales the brightness of the display depending on ambient light levels.
- The value range is 0 to 50, 0 is the lowest level, 50 is the highest. Set to lower number to have a dimmer display when it is dark. A higher number will set a low light display brightness higher.

A blinking '03' will be displayed in the 2 leftmost digits, indicating Option 3, Light sensor offset value. To change the level value, momentarily press the function button (left side). This enters change value mode, the ‘03’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.5 Board Option 4 – Time display interval value

Display: “04 ☐☐ ☐☐”, ‘04’ blinking.

This option changes the time display value.

- This is the time in seconds that the time is displayed.
- The value range is 3 to 120 seconds.

A blinking '04' will be displayed in the 2 leftmost digits, indicating Option 4, time display interval value. To change the interval value, momentarily press the function button (left side). This enters change value mode, the ‘04’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.6 Board Option 5 – Date/Temperature display interval value

Display: “05 ☐☐ ☐☐”, ‘05’ blinking.

This option changes the date and temperature display interval value.

- This is the time in seconds that the date and temperature is displayed.
- The value range is 1 to 24 seconds.

A blinking '05' will be displayed in the 2 leftmost digits, indicating Option 5, date/temperature display interval value. To change the interval value, momentarily press the function button (left side). This enters change value mode, the ‘05’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.7 Board Option 6 – Alarm period duration value

Display: “06 ☐☐ ☐☐”, ‘06’ blinking.

This option changes the alarm period duration value.

- This is the time in minutes that the alarm will be active from the alarm time.
- The value range is 2 to 127 minutes.

A blinking '06' will be displayed in the 2 leftmost digits, indicating Option 6, alarm period duration value. To change the duration value, momentarily press the function button (left side). This enters change value mode, the ‘06’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.8 Board Option 7 – Alarm snooze duration value

Display: “07 ☐☐ ☐☐”, ‘07’ blinking.

This option changes the alarm snooze period duration value.

- This is the time in minutes that the alarm will be silent in snooze mode.
- The value range is 1 to 59 minutes.

A blinking '07' will be displayed in the 2 leftmost digits, indicating Option 7, alarm snooze period duration value. To change the duration value, momentarily press the function button (left side). This enters change value mode, the ‘07’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.9 Board Option 8 – Time offset value

Display: “08 ☐☐ ☐☐”, ‘08’ blinking.

This option changes the time offset value.

- This is the time in milliseconds that the time will be offset every hour.
- The value range is -9500 to 9500 milliseconds (thousandth of a second).

Warning: This value is calibrated at the factory, and in most cases should not be changed!

A blinking '08' will be displayed in the 2 leftmost digits, indicating Option 68, time offset value. To change the offset value, momentarily press the function button (left side). This enters change value mode, the ‘08’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.10 Board Option 9 – Floor LED off light level set point value

Display: “09 □□ □□” , ‘09’ blinking.

This option changes the Floor LED off light level value.

- This is the level that turns off the Floor LEDs depending on ambient light levels. When light is below this level, the Floor LEDs are off (in options 11 & 12)
- The value range is 0 to 100, 0 is the lowest level, 100 is the highest. A low value will turn off the LEDs when the light is low, 18 is a good value to try. If it is too low, the LEDs will not go out, even in full darkness. If too high the LEDs will always be off.

A blinking '09' will be displayed in the 2 leftmost digits, indicating Option 9, Floor LED off light level value. To change the level value, momentarily press the function button (left side). This enters change value mode, the ‘09’ will stop blinking.

Change the current value by pressing the function button. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.11 Board Option 10 – GPS/WiFi timezone offset value

Display: “10 ☐☐ ☐☐”, ‘10’ blinking.

This option changes the GPS/WiFi time zone offset value. If the GPS/WiFi module is not installed, this option has no effect.

- The time zone is used to offset the UT time that the GPS/WiFi module sends to the clock. This allows the clock to display the correct local time. Note: Some WiFi modules send the correct local time, in this case the time zone should be set to ‘0’.
- The value is from -11 to +14, and is in hours. This value is in standard time, NOT daylight saving time. Daylight saving time is calculated by the clock, if selected. See the supplemental GPS/WiFi manual for a map and more information how to figure out the time zone offset value, or if it is needed.
- Negative value is indicated by the left most colon ON.

A blinking '10' will be displayed in the 2 leftmost digits, indicating Option 10, GPS/WiFi time zone offset value. To change the offset value, momentarily press the function button (left side). This enters change value mode, the ‘10’ will stop blinking.

Change the current value by pressing the function button. For a negative number, the left most colon will be on, for a positive number, the left most colon will be off. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

6.1.12 Board Option 11 - Light offset alarm snooze value

Display: “11 ☐☐ ☐☐”, ‘11’ blinking.

This option changes the light offset alarm snooze value.

- This controls the change in light level needed to put the clock in snooze mode.
- The value range is 1 to 200 Lux, 1 is the lowest level, 200 is the highest. Set to lower number to have a smaller change in light trigger the snooze function. A higher number will cause a larger change in light levels to trigger the snooze function. Note: Too small a value will cause the snooze mode to be triggered right away.
- See alarm modes to see which modes enable the light triggered snooze function.

A blinking '11' will be displayed in the 2 leftmost digits, indicating Option 11, light offset alarm snooze value. To change the offset value, momentarily press the function button (left side). This enters change value mode, the ‘11’ will stop blinking.

Change the current value by pressing the function button. For a negative number, the left most colon will be on, for a positive number, the left most colon will be off. Holding in the function button will speed up the change rate. This will increase the value.

To change the direction of the change (value goes up or down), momentarily press the mode button, this will toggle the right most colon on/off:

- Right most colon off – function button will increase value.
- Right most colon on – function button will decrease value.
- Note: The right most colon does not indicate if the value is + or -, only the direction the value changes when the function button is pressed.

To exit the change value mode, press and hold the mode button until the display goes blank. Release the mode button and the clock shows a blinking option number.

7 Trouble Shooting the Clock

This section is a guide to basic trouble shooting of potential problems for this clock.

7.1.1 Display is blank

1) Obvious cause – power cord not plugged in, no power at outlet. I had to ask….
2) Clock is in Display Off mode (see section 5.1.15). Pressing either the mode or the function button will enable the display (for 1 ½ minutes). Set a new OFF time, or disable completely (see section 5.1.18). Also, display is Auto ON/OFF mode and it is dark. The clock could also be in weekend or weekday display OFF mode (see section 5.1.11).
3) CPU locked up, remove power for 10 seconds, reapply power. Clock should go through display self-test (see section 4). Enter correct time and date.
4) Clock failed, contact ColdWarCreations for repair work (info@coldwarcreations.com).

7.1.2 Time not working

1) Display blank, see section 7.1.1.
2) Display or part of display digits blinking. Clock not in normal time display mode. Note: Time will blink during New Year's Eve, see section 5.1.20). Press and hold mode button (right side) until the display goes blank, release button. Clock will now be in normal mode. It may be necessary to set the time/date to the correct value, see section 5.1.1.
3) Display shows '00 00 00' or '11 11 11' … '99 99 99'. Clock is in Anti-cathode poisoning mode (see section 5.1.12). Press either the mode or function button to cancel this mode. The clock will return to normal mode (for one day, the next day the clock will start the anti-cathode poisoning mode at the programmed time).

7.1.3 Date is not displayed properly

1) Clock must be in Display Options 01, 03, 11, 13, 21, 23, 31, or 33 to display the date (see section 5.1.9).
2) If the format is wrong (mm-dd-yy, dd-mm-yy or yy-mm-dd), check date format option (see section 5.1.8).

7.1.4 Temperature display not working

1) Clock must be in Display Options 02, 03, 12, 13, 22, 23, 32, or 33 to display the temperature (see section 5.1.9).
2) If the format is wrong (Fahrenheit or Celsius), check temperature display format option (see section 5.1.10).

7.1.5 Colon(s) not working

1) The display may be dimmed to minimum. Colons are off at this setting (see section 5.1.11).
2) Colons may be disabled with the colon options, see section 5.1.13.
3) Display or part of display digits blinking. Clock not in normal time display mode, colons will display differently. Press and hold mode button (right side) until the display goes blank, release button. Clock will now be in normal mode. It may be necessary to set the time to the correct value, see section 5.1.1.
4) Display shows ’00 00 00’ or ’11 11 11’ … ’99 99 99’. Clock is in Anti-cathode poisoning mode (see section 5.1.12). Press either the mode or function button to cancel this mode. The clock will return to normal mode (for one day, the next day the clock will start the anti-cathode poisoning mode at the programmed time).

7.1.6 Decimal point of tube is faintly glowing

1) Decimal point is glowing when display is off. This is normal, especially visible on left most digit. This is a “pilot” decimal point, and has a constant low current to speed up display time from off display to a digit.

7.1.7 Tube(s) not working

1) Display blank, see section 7.1.1.
2) Tube(s) delay coming on when clock cold or in dark room. This is normal for Nixie tubes – they need external energy to turn on. When it is dark they may not come on right away. Once they warmup, they should be ok.
3) Parts of the digit do not show up. The tubes have Cathode Poisoning. Make sure the Anti-Cathode poisoning function is enabled. If it does not clear after a week or two, the clock will need servicing (new tubes). Contact ColdWarCreations (info@coldwarcreations.com).
4) A Nixie tube(s) does not light up; the clock will need servicing (new tubes). Contact ColdWarCreations (info@coldwarcreations.com).
5) If a tube is bad, Contact ColdWarCreations to have the tube replaced, or (info@coldwarcreations.com) to purchase a tube. If you have your own tube, the Cold War Creations website will have the latest instructions for tube replacement.

8 Maintenance and Care

Cleaning

Use a non-abrasive cleaner on the outer glass case. Do not get any water inside the clock!

Note: Make sure to unplug the clock before cleaning. While operating high voltage is present.

Use

The Nixie clock may be used indoors 50 Deg F. to 120 DegF. Higher or lower temperatures will shorten the life of the tubes.

Never use outdoors!

9 Warranty

Limited Warranty

- What is covered
  The case, circuit board and switches from any manufacturing defects. The Nixie tubes are covered for incomplete digits and/or blank digits. Neon colons are covered for failed colons.

- What is not covered
  Breakage due to misuse, neglect, water damage or outdoor use. Damage due to incorrect voltage converters is not covered. Minor flickering of neon colons is not covered.

- Period of coverage
  One (1) year from date of purchase for the case, circuit board, Nixie tubes, colons and switches.

- What We Will Do to Correct Problems
  We will repair or replace (at our discretion) free of charge. Shipping is not included.

- How You (the customer) Can Get Service
  Email: info@coldwarcreations.com for a conformation number for returns or any questions on this warranty.

Serial Number _____

Inspected

10 Specifications

- Simax brand glass case material
- Laser cut acrylic internal pieces
- 8 bit AVR XMega64D4 RISC processor
- Temperature compensated 32 kHz time keeping crystal
- 115 VAC wall transformer supplying 12 VDC 400 MA maximum current.
- 6 IN-8-2 Soviet Nixie Tubes, 180v anode voltage, running at 3 mA peak, 0.93 mA average. Multiplexed 2x6.
- OR 6 IN-14 Soviet Nixie Tubes, 180v anode voltage, running at 3 mA peak, 0.93 mA average. Multiplexed 2x6.
- Dimensions: 9.8” L x 4.72” H x 4.5” W, 1.5 lbs

- Dimensions: 250mm L x 120mm H x 114mm W, 0.680 kg