
Glass Nixie Tube Clock #3 IN-14 Version



User's manual

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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.

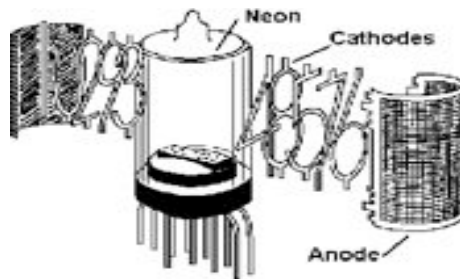
This is the special version of the Glass Clock #3. It uses rare Soviet IN-14 tubes. Each tube is socketed to the board, which allows easy replacement if a tube fails. It’s an excellent size for larger offices and living rooms.

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-14 series of tubes. One interesting feature is the ‘5’ digit. It is actually the ‘2’ digit upside down and reversed, making for a very unique looking ‘5’.

This clock uses socket pins for the Nixie tubes. The pins allow tubes to be changed out without soldering. 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.
- 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 8 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.
- Optional Nixie tube floor lighting LEDs. Can be disabled at night.

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 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.

The clock has two control buttons. On the back left is a black function button, and on the back right is a red 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.

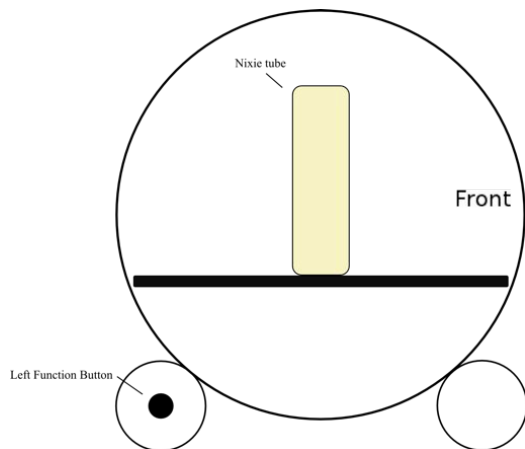


Illustration 1: Side View, Left

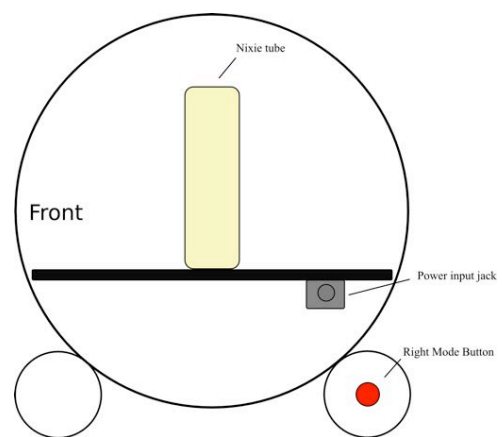


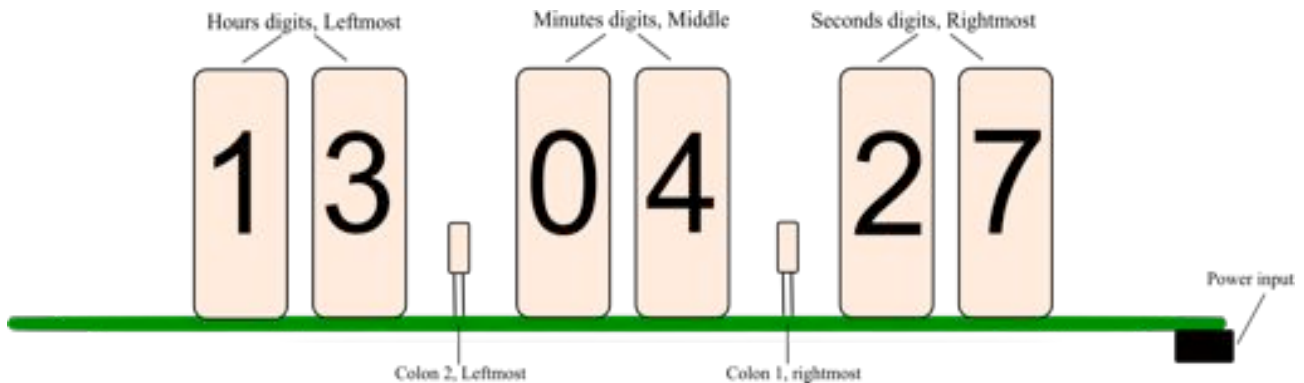
Illustration 2: Side View, Right

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 red mode button (right side) and the black 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 red 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 red mode button until the display goes blank if this happens and try again.

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 red 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 red mode button to skip the time set functions.

To cancel setting the time value at any point, press and hold the red 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.

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, making Daylight Savings time changes easier.

The black 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 red 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 black 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 red 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 Daylight Savings

When changing hours for Daylight Savings time, only the hours need to be changed, the minutes and seconds will stay the same. Seconds will continue to count up during the hours set.

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

The black 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 red mode button (right side) momentarily. The clock will then blink the minutes. Press and hold the red mode button until the display goes blank. Let go of the red mode button.

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

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 red 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 red 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 red 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 black function button (left side) to change the day value (01 – 31).

Once the day value is set to the proper value, press the red 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 red 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 black 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 red mode button), starting with option 1 and ending with option 8.

To exit clock options mode, press and hold the red 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

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', or '02' will be displayed in the 2 leftmost digits, indicating the hour style. To change the style, press the black function button (left side). Press the red 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 red 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. There are 12 different date display/Auto DST formats available:

- ‘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.

A blinking '01' → '33' will be displayed in the 2 middle digits, indicating the selected date display format. To change the format, press the black function button (left side). Press the red 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 red 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.

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.

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

The time will display for 15 seconds, followed by the date (if enabled) for 2 seconds, followed by the temperature (if enabled) for 2 seconds, then back to the time display.

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 black function button (left side). Press the red 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 red 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 black function button (left side). Press the red 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 red 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

Display: “□□:00 □□”, right most colon ON

This option selects the brightness level for the display. There are 5 brightness levels to select. '01' → '04' select a fixed brightness level 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 black function button (left side). Press the red 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 red 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.
- '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 black function button (left side). Holding the function button on will quickly cycle through the hours (0-23, 44, 55). Press the red 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 red 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 black function button (left side). Holding the function button on will quickly cycle through the modes (0-03). Press the red mode button when the desired colon mode is displayed. The next option will be displayed.

To cancel the option function, press and hold the red 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.

- '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 display is on, when the display is off so are the floor Leds.
- '02' = Floor LEDs on auto brightness when display is on, when the display is off so are the floor Leds. Auto brightness adjusts the floor LED brightness with the ambient lighting.
- '11' = Floor LEDs on maximum brightness when 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).
- '12' = Floor LEDs on auto brightness when 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).

A blinking '00' → '02' or '11' → '12' will be displayed in the 2 leftmost digits, with the colons on. To change the enable time, press the black function button (left side). Holding the function button on will quickly cycle through the modes (0-02, 11-12). Press the red 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 red 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.

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 red mode button or the black 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 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 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.

5.1.15 Entering the OFF/ON set time enable

Enter the OFF/ON set time enable by pressing and holding the red 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.

5.1.16 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 black 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 red 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 black 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 red 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 red 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.

5.1.17 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 black 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 red 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 black 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 red 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 red 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.

5.1.18 Disabling OFF/ON time

The display OFF function can be disabled by setting both the OFF and ON time to the same value, such as 00:00. 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.

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

Example two, disable OFF/ON time setting:

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

5.1.20 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.

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 black function button (left side) until the display goes blank. Keep pressing the black function button, and then momentarily press the red 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 red mode button will go to the next option. When the red mode button is pressed at the last option, it will go back to option 0 (serial number).

Pressing and holding the red 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	Time display interval set point value
Option 4	Time/date display interval set point value

6.1.1 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 red mode button to go to the next option.

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

6.1.2 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 * 1000. Examples: a -1000 will reduce the displayed temperature by 1 degree C. A 2500 will increase the displayed temperature by 2 ½ degrees C.
- The offset range is -9999 to +9999 (-9.9 DegC to +9.9 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 black function button (left side). This enters change value mode, the ‘01’ will stop blinking.

Change the current value by pressing the black 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 black 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 red mode button, this will toggle the right most colon on/off:

- Right most colon off – black button will increase value.
- Right most colon on – black 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 black button is pressed.

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

6.1.3 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 black function button (left side). This enters change value mode, the ‘02’ will stop blinking.

Change the current value by pressing the black function button. Holding in the black 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 red mode button, this will toggle the right most colon on/off:

- Right most colon off – black button will increase value.
- Right most colon on – black 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 black button is pressed.

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

6.1.4 Option 3 – Time display interval value

Display: “03 □□ □□”, ‘03’ 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 '03' will be displayed in the 2 leftmost digits, indicating Option 3, time display interval value. To change the interval value, momentarily press the black function button (left side). This enters change value mode, the ‘03’ will stop blinking.

Change the current value by pressing the black function button. Holding in the black 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 red mode button, this will toggle the right most colon on/off:

- Right most colon off – black button will increase value.
- Right most colon on – black 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 black button is pressed.

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

6.1.5 Option 4 – Date/Temperature display interval value

Display: “04 □□ □□”, ‘04’ 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 '04' will be displayed in the 2 leftmost digits, indicating Option 4, date/temperature display interval value. To change the interval value, momentarily press the black function button (left side). This enters change value mode, the ‘04’ will stop blinking.

Change the current value by pressing the black function button. Holding in the black 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 red mode button, this will toggle the right most colon on/off:

- Right most colon off – black button will increase value.
- Right most colon on – black 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 black button is pressed.

To exit the change value mode, press and hold the red 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

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

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 _____

10 Specifications

- ⤴ Simax brand glass case material
- ⤴ Laser cut acrylic internal pieces
- ⤴ 8 bit AVR Mega168A RISC processor
- ⤴ Temperature compensated 32 kHz time keeping crystal
- ⤴ 115 VAC wall transformer supplying 12 VDC 200 MA maximum current. Also a 9 VDC 300 mA supply may be used.
- ⤴ 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