



6 Digit nixie tube clock board for Z-568M, RJZ-568M, ZIN-70 nixie tubes

Version 2.2

Manufactured in Republic of Georgia

Introduction

Ziniko'70 is a 6-tube nixie clock board, compatible with RFT Z568M, RJZ-568M, ZIN-70 nixie tubes. It is physically compatible with Millclock's nixie tube clock cabinets, so can be directly used as drop-in replacement for Millclock's PCB to get additional features, better features and control over individual segment brightness.

Features

This clock has the following features:

- Built in GPS receiver and Wi-Fi module for time synchronization
- Over the air firmware updates with full per-user personalization
- DST mode selection, Time zone selection.
- Flexible options for brightness adjustment and tube saving features
- Temperature measurement options
- Built-in LCD screen for menu setup and adjustments
- Alarm clock function, hourly chimes
- Advanced backlight controls, including dynamic lighting
- 12/24-hour modes, C/F temperature display, all user selectable
- Wireless remote control for quick access to clock's major functions
- PIR sensor* for enabling the clock display only when motion is detected
- Fully featured Web GUI for clock remote control and setup – you can check live demo here: <https://www.tiktoki.ge/projects/Ziniko/preview.html> or check it's manual: <https://www.tiktoki.ge/projects/Ziniko/webgui.pdf>

If you prefer to read this manual in handheld device optimized format, with reduced clutter and simplified explanation, you can refer to this file:

<https://www.tiktoki.ge/projects/Ziniko/reference.html>

** PIR sensor is optional – It is useless if you use original ZIN-70 cabinet from Millclock, which comes with translucent acrylic case, which prevents PIR sensor operation.*

Specs

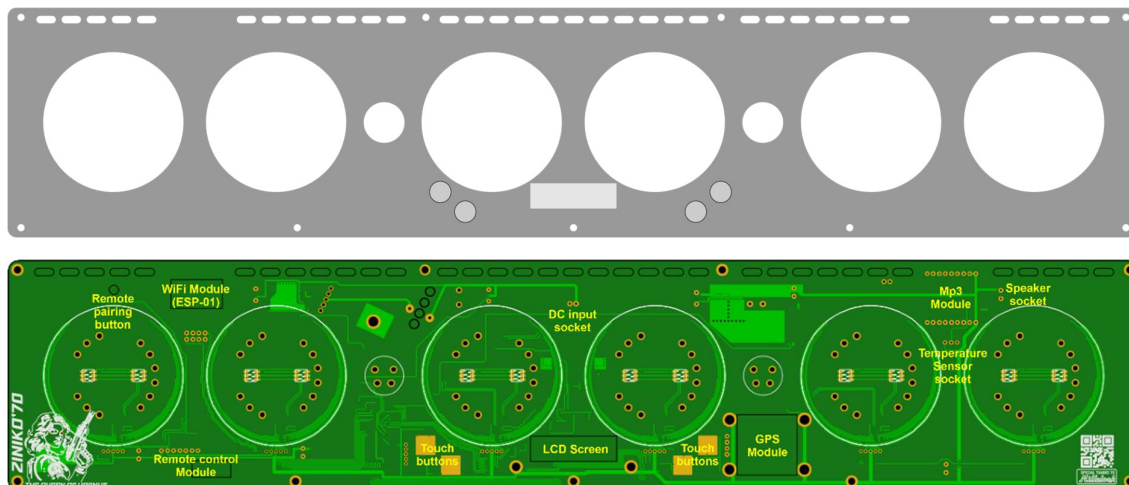
Physical dimensions:	472x96x20 mm approx. (Exact mechanical drawings for CAD/CAM are available for download separately)
Weight:	<300 grams
Power supply:	DC12-24V, <20W
Tubes supported:	RJZ-568M, ZIN-70, Z568M
Speaker output:	Up to 3W, 4-8 ohm load

Getting familiar with your clock

This is a high-tech product, which uses high voltage, which can be lethal if improperly handled. So please read this manual completely before plugging in your clock or making any modifications to it.

This clock kit consists of two components, one is PCB with the electronic parts on it and 2nd is the translucent acrylic cover (**optional, available for extra fee only**), which is placed over the PCB for sleek look and safety measure to prevent accidental

high voltage shock. **Please note:** To protect from scratches, acrylic cover comes with protective sheet on it from both sides. Remove it only prior to final installation. Pay attention to top and bottom sides of the sheet – they are marked with appropriate stickers.



(Drawings are approximate, used to give general idea about control layout, actual board will differ slightly both in color and appearance)

PCB is installed with components facing down, and once installed, you put acrylic sheet over it, plug in tubes and you're done. The diagram above shows location of controls and connectors on the PCB. While there are a lot of them, end user needs only the following:

DC power input – located at the center of PCB, it is used to provide clock with 12-24V DC power. Please mind polarity, because if you accidentally reverse it, clock will be permanently damaged.

Speaker connection port – located at the top right side of the PCB. Connect either included speaker, or if you want louder sound, provide your own, with power at least 3W and impedance in 4–8-ohm range. You can also leave it unconnected, if you do not want alarm functionality. **PLEASE NOTE:** If you're upgrading your existing Millclock cabinet and using it's built in speaker, **DO NOT SET ALARM VOLUME ABOVE 4**. Doing so will permanently damage the speaker.

Temperature sensor connector – this is used to connect DS18B20 temperature sensor. Pinout is written on PCB. Similarly, this sensor also can be left unconnected, it is not necessary for proper clock operation.

Besides this, there are some more connectors available on the PCB. Depending on your order, they can be occupied with modules, or left blank, so you can install your own if needed. These modules are:

ESP-01S module. This module provides internet accessibility for NTP time synchronization. It comes fully pre-configured and you need to only provide it with your WiFi AP name and password. Please read the [Wi-Fi web GUI manual](#) for Wi-Fi setup guide.

RF Remote module. This clock supports optional, 4 button RF remote control modules. The module connects to main PCB at bottom left side. If you ordered clock PCB without this module, you can later install one by yourself – these are sold on

ebay/aliexpress and reference photo of the module of correct type is given at the end of this manual.

New RF remote pairing button. If you somehow manage to lose original RF remote, or it no longer works or you just want to replace it for whatever reason, then you have to press this button with some sharp object (like pen tip, paper clip end, etc.) and with delay of 2-3 seconds, press buttons 1-2-3-4 on your new remote, so clock will “learn” it and it can be used freely. (This button is soldered on demand only, you can use similar button on RF receiver itself, if needed)

MP3 module. This module is used to play hourly chimes, alarm tones, keypress sounds and other notifications. **Please note – do not delete pre-loaded content from the MP3 module** – doing so will mess up alarm sounds/hourly chimes. If you accidentally deleted them, you can restore them by downloading them from our website.

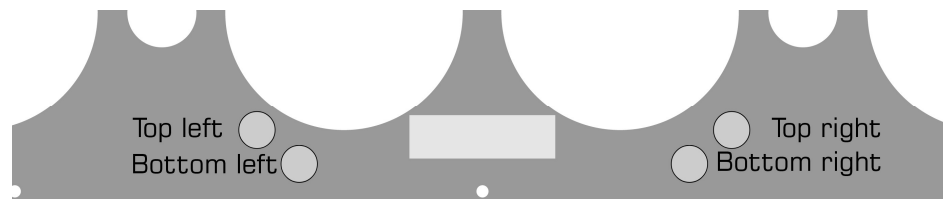
Powering on, first run & reset to default

When you power up clock, several self-tests are conducted and “welcome” is shown on the LCD screen along with the current firmware version. After that, clock enters normal operation and LCD screen is being turned off. If supply voltage is insufficient, the backlight of tubes will blink red and “low voltage” warning will be shown on LCD.

If you have messed up with the settings and want to reset clock to defaults, unplug the clock, press and hold both right buttons, power it on, release buttons once you hear the beep - defaults will be loaded.

Clock setup is done via the simplified, easy to navigate menu, by using on board LCD screen and touch/physical buttons around it.

There are 4 touch or physical buttons around the LCD screen. Two on the left and two on the right, as shown on the drawing below:



To enter the setup, when clock is in normal mode, touch (or press) one of four buttons to enter appropriate menu.

Menu operation:

There are 4 menus total.

These menu items are:

- Time/Region set (top left button to enter)
- Alarm settings (bottom left button to enter)
- Appearance set (top right button to enter)
- Maintenance (bottom right button to enter)

When you enter any of the menus, button functions are as follows:

Top left button: Move to previous menu item/parameter

Bottom left button: Move to next menu item/parameter

Top right button: Increase selected parameter

Bottom right button: decrease selected parameter

Both right buttons pressed simultaneously: Save settings and exit current menu

Time/Region set menu is used to set up time, date, region format.

From there you set the region – either 12-hour mode with temperature being displayed in Fahrenheit scale, or 24-hour mode, with temperature being displayed in Celsius scale. Other menu items are self-explanatory, such as calendar format, daylight savings, UTC time zone and so on. so, there is no need for detailed description, except the date and month. If you set illegal date, such as February 31st, clock will still work, but alarm functions might be affected (but if you have GPS/NTP sync enabled, proper values will be fetched automatically). Also, in this menu you can select whenever you want to sync your clock with GPS and NTP time. If enabled, sync is performed once per hour and while both receivers (GPS & NTP) are queried, priority is given to GPS, if available. If you want to manually force sync at current moment, go to Maintenance/GPS & NTP status sub menu. Once you enter that menu, press any right button and sync will be automatically performed.

Also, in the same time/region set menu you can select hourly chimes – either turn them off completely or select one from 3 available sounds. PLEASE NOTE: To adjust volume of hourly chimes, use “Alarm volume” adjustment in the alarm menu. You can also configure the starting and ending hours for chimes. By default, these are set in that way, that chimes will start at 09:00 and end at 23:00

Alarm setting This menu has the following options:

Alarm mode – select whenever you want it to be disabled, enabled all week or enabled on work days only.

Alarm sound – select desired sound from one of the preset sounds.

Alarm volume – you can adjust alarm volume from this menu. When you select this sub-item, previously selected alarm sound will start playing and you can use keys at right to adjust the volume. This volume setting also affects hourly chimes/intro melody volume.

Alarm duration – you can set how long alarm will be ringing (how many repeats of each alarm tone, each of them being roughly 10 second duration).

Alarm flash – it is possible to flash tube backlight while alarm is ringing, so there are 3 options for that – disabled, when backlight stays calm, “all together” – when all tube backlight colors change together and “random” – when tube backlight colors change individually

Appearance set menu is used to adjust tube brightness, enable super saver mode, adjust backlight options. It consists of the following items:

Brightness – there are 8 preset brightness levels and auto mode. If you select later, tube and backlight brightness will gradually decrease in the evening and increase in the morning and stay at high brightness during the day.

Update mode – it is possible to select different digit display options. Selecting “Off” means that digit will just go out and next one introduced – as on any usual clock. When “Fade” is selected, the digit gradually fades out, and next digit fades in. When “Crossfade” is selected, the current digit brightness will start decreasing and brightness of the next digit will be slowly increasing. With “Blur” option, whole tube will be blurred and when cleared, next digit will appear. “Slot machine” cycles thru all the digits when particular tube displayed value changes. “Running” makes digits to “slide-in” from right side to left. When you scroll thru the options in this menu, digit animation will be played on all tubes, so you can have idea how it looks.

Colon style – This clock allows to have some cool animation with digit dividers too: “On/off” dots will just come on and off – without brightness change. “Smooth” – dots will fade in and then fade out, each second – “Slow” – same as previous item, but dots will operate on each 2nd second, creating more relaxed view.

Refresh mode – When this is enabled, clock will cycle thru all the digits in all the tubes once per hour – some people believe that this is good for tube health, we actually don’t, but since people asked – why not to implement?

Backlight mode – From there you can turn off tube backlight off, set it to “normal” – fixed color or set it to “gradient” – when colors change from left to right.

Backlight preset – Allows you to select preset backlight color or preset backlight gradient set.

Breathing light – this item sets dynamic backlight options. There are 3 choices – when set to “off”, backlight is fully static and colors are defined by “backlight mode” menu item. There are two additional choices – “Smooth” – when all tube backlight colors change color smoothly and “Heartbeat” – when color change moves from left to right and back in loop. Please note, “Breathing light” overrides “Backlight mode” presets, so if it is enabled, changing backlight to “normal” or “gradient” will have no effect.

Tube saver – enabling this option will completely turn off the clock digits and backlight at night (or any other time period you desire, like while you’re at work). functions, including alarm, will operate as usual, and pressing any key on the remote control will “wake up” clock display for 3 seconds. In case of need, default time period can be customized in the “maintenance” menu.

Start hour/End hour – These define when to start and end tube saver activity.

Motion sensor – Clock can be equipped with motion sensor, which will turn off clock digits and backlight, if there’s no motion for a certain period. In this sub-menu, you can either disable this sensor completely or enable it and set the time minutes in the next menu, how long digits will stay on after the sensor detects the motion.

PLEASE NOTE: Do not enable this option if sensor is not present physically.

Motion on time – From here it is possible to define, how long the clock stays on after motion sensor had triggered, available choices are 1-10 minutes.

Keypress beep – you can either enable or disable sound feedback when you press any of the keys.

Leading zero – based on your decision, you can suppress the leading zero, so instead of displaying say 07:25:39, clock will display 7:25:39.

Display what – here you select what is displayed on the nixie tubes – only time, temperature or calendar too. There are several choices, which are quite self-explanatory. Temperature and calendar are displayed for 4 seconds and then clock returns to normal mode.

Update speed – how often clock automatically goes to calendar/temperature display. This can be set in 1–10-minute range.

Maintenance – in this menu, you will find information about clock status, tube calibration, connectivity status,

FW Version – displays current firmware version.

Sync status – when you select this option, you will see the status for GPS and NTP – whenever time sync is received from any of these sources. Please note, GPS has priority over NTP, so if GPS signal is available, clock will use it and won't use NTP, if not, it will fall back to NTP. In general, clock uses quite stable RTC chip, so you will hardly need GPS or NTP sync at all. Also, pressing any button at right while on this item in menu, it forces GPS or NTP sync to be synced right now. The following information will appear there:

“Data” – means that receiver is present, and it is currently looking for satellites (GPS) or looking for internet (Wi-Fi)

“Lock” – the receiver is connected and sync is established.

“None” – there's no reception, receiver is not physically present or malfunctioned.

Wi-Fi status – You will see the additional status of your Wi-Fi connection here – whenever it is connected to the access point, entered setup mode, searching for the access point and so on.

“Setup portal” – Clock is waiting for your connection to set-up the Wi-Fi link.

“AP not found” – previously saved access point not found – bad signal or whatever reason can be. Either restore the AP access, or restart the clock, it will enter Wi-Fi setup mode automatically and specify new access point.

“No access” – Wi-Fi is connected, but there's no internet connection incoming.

“Not found” – Wi-Fi module not available.

Once Wi-Fi is connected, you will see the current clock IP or it's hostname in that status message. Like 192.168.100.142 or nixie.local

Min. Brightness – defines the minimum brightness for the tubes. You might want to increase this parameter if your tubes are worn out and at low brightness they're lit only partially. Default value is 100 and it is advisable not to change it unless needed.

Max. Brightness – defines the maximum brightness for the tubes. Default value is 3000 (maximum). Again, there's no need to touch this setting at all – default values are ok. You only need to adjust this if auto brightness is too bright for your taste (like you're placing the clock in dimly lit room and want to extend tube life by reducing maximum current). **WARNING! If you use smaller nixie tubes via the adapters, like IN-18, DGM-01 you need to adjust this to 1000.** Leaving them on 3000 might permanently damage both clock and the nixie tubes! If you want to use this board with even smaller tubes, like IN-14, Z570M, IN-8 and so on, then you need to connect

10K resistor in series with anode, to avoid permanent damage. Increase resistor to 22K for even smaller tubes like IN-16, IN-2, IN-17, Z5900M and so on.

Select tube – here you can select the tube which has issues with digit brightness or illumination evenness. Count starts from left to right.

Select digit – here you can select the digit which has the issues.

Adjust current – here you can adjust the current for the selected digit, until the required brightness or light uniformity will be achieved. Current can be adjusted in - 100 + 1000 range. For ease of adjustment, same digits in other tubes will lit up, so you can compare and set similar brightness.

Set defaults – Resets all the user settings to their default values. You need to press both right keys at same time to perform this action.

" Slots" game

This clock has built in "slots" game, which can be started by pressing "A" button on the remote. In this mode, clock display is divided into two parts – left 4 tubes are "slots" tubes, while ones at right show your score. When you press the "A" button again, digits will "spin" – their spin rate will increase from left to right. Your goal is to stop spin on the same number from left to right – no missing numbers in between, so say you stopped it on 2202 – it will be counted as 2 digits, not 3.

The score is as follows:

No digits matched- lose 1 point

2 digits matched – gain 2 points

3 digits matched – gain 5 points

4 digits matched – gain 10 points.

Initially, you'll get 50 points. When you reach 99 points, the score resets to 50 and the next level (faster spin) starts. There is total 4 levels. To exit the game, press any other button on the remote. During the game, LCD screen will be also on, providing better information about current scoring.

Remote control operation

Your clock comes with (optional) RF remote control. The remote has 4 buttons which are used for the following:

Button "A" – Launches the "slots" game.

Button "B" – changes clock display to temperature. Display will return to normal mode after 4 seconds or by pressing that button again.

Button "C" – changes clock display to calendar. Display will return to normal mode after 4 seconds or by pressing that button again.

Button "D" – turn clock digits and backlight on and off, clock continues to function normally, including alarm and hourly chimes, just displays nothing.

Service hotkeys

There are some service functions, which can be accessed if you keep the following button pressed while powering clock on. These are meant to be used during initial

testing only and they make no use for end the user, so this description is provided to let the user know what happened when he pressed buttons on power up and that clock is not malfunctioning.

Top left button: Backlight cycles thru red, green and blue colors

Bottom right button: Tube segments display 012345 or 123456

Top right button: Activating bootloader for firmware update

Bottom right button: Only legends will understand

Manual & firmware revision history

1.0 – Initial release

1.1 – Added new features: Motion sensor interaction, touch or physical buttons for menu editing

1.2 – Added new feature: UTC time zone selection for GPS, updated some routines to make clock start up or apply settings faster.

1.3 – Added the following new features: Ability to turn on/off GPS/NTP sync, reset to default option, manual updated with additional details and structure optimized.

1.4 – Improved temperature display routines, fixed reset function not clearing dot animation type.

1.5 – Modified dot animation sub-menu, minor improvements in tube calibration menu.

1.6 – Further clarified and optimized manual.

2.0 – Manual had been updated with new features available in MK3 boards.

2.1 – Removed obsolete data, expanded status messages information and added quick Wi-Fi setup guide.

2.2 – New features added, Wi-Fi setup manual and Web GUI manual moved to separate files.