# Quick Setup Manual B7971 Digit NIXIE Clock

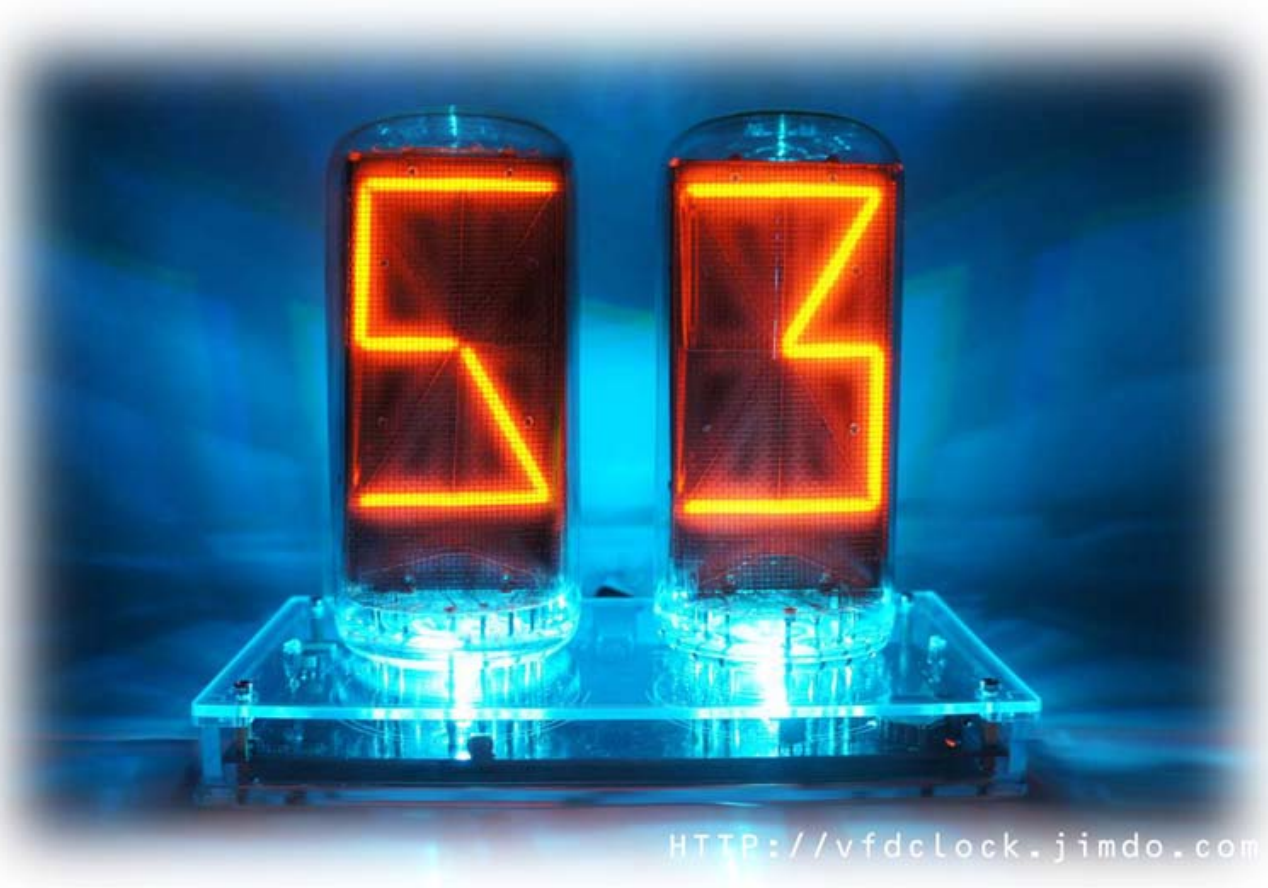
Version:1.0. (04-18-2019).

Download product documentation and the related software at:

**HTTP://vfdclock.jimdo.com**

or You can contact me via email:

**zjjszhangf@gmail.com**



# Contents

# Notice

In order to drive the NIXIE tube, some internal equipments are under the High Voltage(up to 180V DC),please do not use this clock outside or in any wet conditions,please do not touch any part inside the clock when power supply is turned on.Always keep it away from kids.

# Specifications

**Tube Name**: B7971
**Tube Diameter**:50mm;
**Tube Height**:11.5mm(12.3mm +leg);
**Digit Height**:52mm;

**Clock Supply**: 5V DC via MINI-USB;
**Working Current**: ~660mA;
**Clock Size**:
156mm(L)*80mm(W)*18mm(H)-(*no including the tube);
**PCB Size**:146mm*70mm;
**PCB Color**:Black;
**Weight**:~250g(+tube);


**The clock works with any standard USB supply,use only high-quality adapter!**

# Features

You can replace the tube by yourself without using any tools.

1).5V **Mini-USB** powered, easy to be used. Can connect to your computer's USB plugs directly.
2).Support **12H** or **24H** display modes, can show "."as" A/P" in 12H time format. Leading zero blanking is programmable.
3).Display date in **all format**: YY.MM.DD or DD.MM.YY or MM.DD.YY or even MM.YY.DD.
4).Support 3 different Effs: **Normal/Fading/Cross Fading/Flashing/Loop** for displaying time.Support 6 pre-defined **Fonts**;
5).High accuracy **DTCXO** (temperature compensated crystal oscillator) **inside,+-4.94 seconds(MAX)** per month;
6).Simple setting by using 2 buttons only and supports **IR remote control**(optional).
7).**Three alarms** with **weekends** ON/OFF support, can be controlled individually.
8).**Three programmable Auto Power ON/OFF mode**, can turn ON/OFF NIXIE tubes in any time you want. This function can save tubes life.
9).8-level adjustable NIXIE tube bright with **Auto-brightness** feature(its ability to

adjust the tube brightness depending on the current environment).
10). **Rechargeable Backup Battery** or **Farad capacitor** keeps RTC running during power outages.(May use CR1220 socket instead in some version).
11).Tri-colored **RGB LED** mounted under the NIXIE tube. This LED can display any color with a lot of pre-defined auto color change effects.
12).Store user settings in **non-volatile memory**.
13).Support temperature sensor(**optional**);Support PIR sensor (**optional**) in some versions.
14).Beautiful CAD designed **acrylic case** made using a laser cutter makes the clock look beautiful. You can assemble/disassemble the case by using only 4 screws on the bottom of the case. The case also has 4 **bumpers** as feet on the bottom of the case in order to stop to prevent case's damage.
15). Support **Wireless GPS Module** (**optional**), can sync time via wireless signal(*Need to have a GPS wireless time station as time signal sender);
16).Support **PIR** (**human sensor module**)(**optional**) to turn the clock ON/OFF by detecting the human body;

## Turn Power ON/OFF

When you plug the MINI-USB with power supply to the clock, the clock will turn on automatically, with NIXIE tube displays current time with the LED running in breathing mode.
In this mode([**Time display mode**]),press and keep the **[+]** button down then single click the **[SET]** button, you can turn the clock power on/off. When you turn the clock power off, the HV supply will shutdown, and the LED will turn off, but all the Alarms and Auto Power ON/OFF and RTC functions will still be running;

*Let the clock face to you, the left button is **[SET]**,and the right button is **[+]**.
*If can not turn on ,please check if have plugged the PIR sensor in the clock,try to unplug the PIR or check the PIR switch to see if on the [OFF] loc.

## Turn LED ON/OFF

In **[Time display mode]**,single click **[SET]** button will switch the LED in Play/Pause/OFF modes.

## Change the LED's Color Pattern

In **[Time display mode]**,press the **[+]** button down for about 2 seconds, then release the button, the LED will switch to the next color pattern mode;

# Quick Start Guide for setting up the current time

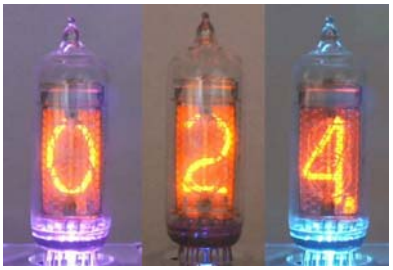
When the power On ,the clock displays the current time. If the time it displays is not correct, you need to set it by yourself. Here is the quick guide for you to set the current time.

When power On,the clock displays the current time one by one,like 20:52=[20.52.__]

**Long Click** the **[SET]** button

Enter the setting mode,it displays the current eff in 0/1/2,ignore it.

**Single** Click the **[SET]** button



Shows the current time format, 024=24H&0-leading, ignore it.

**Single** Click the **[SET]** button

Now you can set the **HOUR(S)**. Using **[+]** key to change the number.

**Single** Click the **[SET]** button

Now you can set the **MINUTE(S)**.Using **[+]** key to change the number.

**Single** Click the **[SET]** button

Return to the NORMAL TIME DISPLAY MODE.

# Switch display mode and change settings

## 1. Time Display Mode

After power on initialization, the clock will display the current time in [HH.MM.] format, where [HH.] is the current Hours (in 00-23 or other range/style,depends on the time format you have set), [MM.] is current Minutes (in 0~59).
In this mode ,after press the [SET] key down for at least 2-sec(Long Click),it will switch to the time related setting mode, and you can short or long click the [+] button to change the value, and single click the [set] button to switch to another settings.
In this setting mode you can set:
**[Display Effect 0:x]**:0 (normal effect)/1(Fade effct)/2(CrossFade effect);
**[Time Format]**:024(24H with 0-leading)/12(12H)/012(12H with 0-leading)/[.12](12H with dot as PM);
**[Set Hour]**: set time hour in [0~23];

**[Set Minute]**:set time minute in [0~59];

*if you changed the time value(hour and(or) minute),the second will set to 00 automatically.

## 2. Date Display Mode

When in the **[Time Display Mode]**,if you click the **[+]** button you can switch to the **[Date Display Mode]**. In this mode the tube displays date in preset format, like DDMMYY/MMDDYY/YYMMDD/YYDDMM. The year displays with left&right dots all light up.
eg:In **[MMDDYY]** format,the date shows like **[02.28..1..4.]** which means Feb.28,2014;
You can long click the **[SET]** button to switch to another settings, which you can set:
**[DATA Format 1:x]**:0(DDMMYY)/1(MMDDYY)/2(YYMMDD)/3(YYDDMM);
**[Set Year]**: set year in [2013.~2099];
**[Set Month]**: set month in [01~12];
**[Set Day]**: set day in [01~28,29,30,31],depends on the year and the month that you have set.

*After you finished setting all the values in this mode, you will return back to the current display mode, then you can single click the **[+]** button to switch to other mode, or single click the **[SET]** button to return the **[Time Display Mode]** immediately.

## 3. Temperature Display Mode (Optional)

When in the **[Data Display Mode]**,if you click the **[+]** button you can switch to the **[Temperature Display Mode]**. In this mode the tube displays the temperature got from the temperature sensor.
eg: The temperature date shows like **[26.58]** which means 25.68° C or ° F, depending on the unit you have set; If the clock has no temperature sensor been installed, it shows 00.00;
**[Temperature Unit]**: temperature display unit,[0] for ° C,[1] for ° F ;
**[Temperature error adjustment]**: adjustable temperature display error adjustment value, step+-0.1° C. The left dot light up when set a negative value;

## 4. Alarm Display Mode

Same, click the **[+]** button, switch to the **[ALERT DISPLAY Mode 1/2/3]**;
The clock supports 3 individually alarms with weekends ON/OFF;
**[.2.1 HH.MM.]**: displays the first alarm information. The first[.2.] means "alarm", the next 1 means "alarm 1"(for alarm2/alarm3 shows [.2.2]&[.2.3]),the hh&mm shows the alarm time in hour:minute;
Long click the **[SET]** button for setting the alarm information:
**[Set Hour]**: set alarm hour in [00~23];

**[Set Minute]**: set alarm minute in [00~59];
**[Set Alarm Option]**: 0(Alarm OFF)/1(Alarm ON)/2(Alarm ON-except weekends).

## 5. Auto Power ON/OFF Display Mode

Same, click the **[+]** button, switch to the **[AUTO POWER ON/OFF DISPLAY Mode 1/2/3]**;
The clock supports 3 programmable Auto Power ON/OFF mode;
[.3.1 ]: displays the Auto ON/OFF mode and the index number. The first[.3.] means " Auto Power ON/OFF mode ",the next 1 means " Auto Power ON/OFF 1"(It shows auto2 and auto3 mode like [.3.2]&[.3.3]).
Long click the **[SET]** button for setting the Auto Power ON/OFF information:
**[Set Enable]**: set this Auto Power ON/OFF enable or disable, 0(Disable)/1(Enable);
**[Set Turn On Hour]**: set auto turn on hour in [00~23];
**[Set Turn On Minute]**: set auto turn on minute in [00~59];
**[Set Turn Off Hour]**: set auto turn off hour in [00~23];
**[Set Turn Off Minute]**: set auto turn off minute in [00~59];
**[Nixie Brightness]**: 0(Auto-Brightness)/[1~8]for brightness(8 is the brightest);

## 6. Misc Mode

For misc mode, it displays the **[.4.]** as index.
Long click the **[SET]** button you can enter the miscellanies setting mode.
**[Set NIXIE Brightness]**: 0(Auto-Brightness)/[1~8] for brightness(8 is the brightest);
**[Click Beep Enable]**: 0(Disable)/1(Enable);
**[Set Beep Alert Style]**:[0~3] for 4 different beep style;
**[Set Alarm Beep Loop Times]**: in [05~99] range;
**[Set Font]**: in [0~5] range;

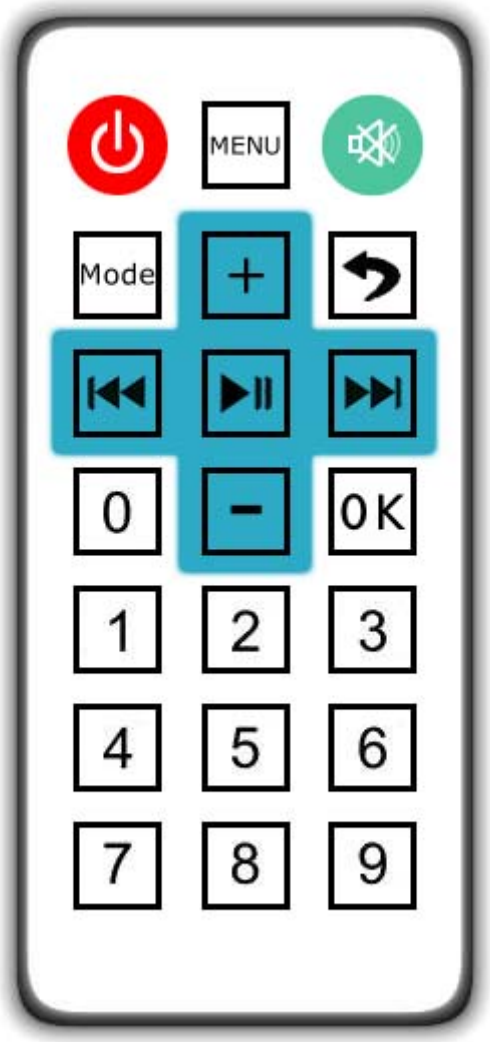
## 7. Version Display Mode

For this mode it displays the version num on NIXIE tube, like **[.5. 1.0.]** means current software version is 1.0;
Long click the **[SET]** button to enter the setting mode:
**[IR Test Mode]**:Shows the IR remoter code which you pressed. You can test your IR remote controller in this mode;
**[Reset All]**:set this number to **[1]**,then click the **[set]** button, all the settings will be reset to the default, and the clock will auto reboot itself when finished.

## Tips

1.In any [**Display Mode**],single click [**SET**] button, can return to the [**Time Display Mode**] directly;
2.You can save the current Led color by just pause it, and when the next time you turn the clock on(Soft Power On),this color appears automatically;

## Infra Red (IR) Remote Controller functions




**Power**: Press the button to shut down/turn on the clock.
**Menu**: Press the button to enter the setting menu of the current display mode, same as [SET] button.
**Mute**: Press for mute the buzzer.
**Mode**: Press the button to switch the time display effects.
**Return [<-']**: Press the button to return the [Time display mode] directly.
**[+]**: Press to change values in ascending order.
**[-]**: Press to change values in descending order.
**Previous [>>|]**: Press the button to go back to the previous menu.
**Next [|<<]**: Press the button to go to the next menu.
**PLAY [>||]**: Press the button to switch the LED in Off/Pause/On modes.
**OK**: Press the button to switch the LED color.
**[0~9]**: Press the buttons to change the values directly.

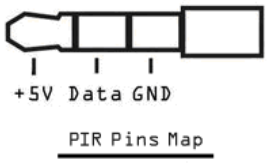
Tips:
Any IR keys can turn on the nixie clock for about 4 seconds when the clock is on the soft power off mode;

If you are trying to use the remote control for the first time, unplug the plastic film in the battery case.
If there is no battery included, place a CR2025 battery by yourself, and make sure the battery is placed at the right polarity according to the marking on the battery holder.
Make sure the batteries in the remote control are fresh.

*To insert the battery into the remote control, follow the instructions printed on the back side of the remote control.

# The HC-SR501 Passive Infrared (PIR) Motion Sensor

The SR501 PIR Sensor will detect human motion via infrared changes.The device will detect motion inside a 110 degree cone with a range of 3 to 7 meters.The Pins map is shown blow.



PIR Pins Map

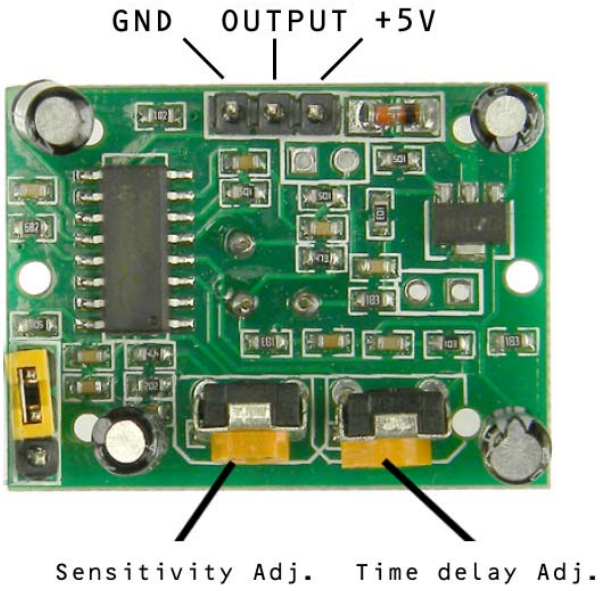
* May have a 3-Band switch on PCB or PIR, with [OFF] [Auto] [ON] function,when [ON]/{OFF} will turn the clock on or off,when switch to [AUTO] will connect to the PIR sensor, and controled by the sensor detections.

if wanna use the PIR,please remember to turn the switch to [AUTO];

To prevent the circuit short, recommend turn the main power off when plug the 3.5mm Sensor plug in the socket.There are two 3.5mm socket on PCB,one is for PIR(with "Motion Detector"), the other is for GPS(With GPS or UART mark),do not go wrong;

The module features adjustable sensitivity and time delay adjustments,you can chenge the value by turn the potentiometer;

Jumper Set:
H:Repeat Trig Jumper may not exist,
L:Single Trig set to [H] in default




**PIR Range (Sensitivity) Adjustment**

Recoommend to turn the potentiometer into middle location,it will cover about 3m range.

**Time Delay Adjustment**

It determines how long the output of the PIR sensor module will remain high after detection motion. We recommend set range to 1~2minute(s),it means turn the potentiometer into the middle part;

Please note this is a MOTION DETECTOR sensot, if it turns off but your are still near it, try to move your body or wave your hand in from of the sensor to turn it ON again.

Do not cover anything in front of sensor lens,PLS!!!

# Single Digit Nixie Clock Operations Cheat Sheet

| 1st Level | 2nd Level | 3rd Level | Operation set with [+] |
|---|---|---|---|
| Long [SET] | | | **Enter Time Display Mode [.0.x]** [Display Effect 0:x]:0 (normal effect)/1(Fade effect)/2(Cross Fade effect); |
| | [SET] | | [Time Format]: 024(24H with 0-leading)/12(12H)/012(12H with 0-leading)/[.12](12H with dot as PM); |
| | [SET] | | [Set Hour]: set time hour in [0~23]; |
| | [SET] | | [Set Minute]:set time minute in [0~59]; |
| | [SET] | | Return to Time display |
| | | | |
| [+] | | | **Date Display** |
| | Long [SET] | | **Date Display Mode [.1.x]** [DATA Format 1:x]: 0(DDMMYY)/1(MMDDYY)/2(YYMMDD)/3(YYDDMM); |
| | | [SET] | [Set Year]: set year in [2013.~2099]; |
| | | [SET] | [Set Month]: set month in [01~12]; |
| | | [SET] | [Set Day]: set day in [01~28,29,30,31],depends on the year and the month that you have set. |
| | | [SET] | Return to Date display |
| [+] | | | **Temperature Display Mode** |
| | Long [SET] | | [Temperature Unit]: temperature display unit, [0] for ° C,[1] for ° F ; |
| | | [SET] | [Temperature error adjustment]: step+-0.1° C |
| | | [SET] | Return to Temperature Display Mode |
| | [+] | | **Alarm 1 [.2.1 HH.MM.]** |
| | | Long [SET] | [Set Hour]: set alarm hour in [00~23]; |
| | | [SET] | [Set Minute]: set alarm minute in [00~59]; |
| | | [SET] | [Set Alarm Option]: 0(Alarm OFF)/1(Alarm ON)/2(Alarm ON-except weekends). |
| | | [SET] | Goes to next Mode |
| | [+] | | **Alarm 2 [.2.2 HH.MM.] (Set options same as above)** |
| | [+] | | **Alarm 3 [.2.3 HH.MM.] (Set options same as above)** |
| | [+] | | **Auto Power ON/OFF Display Mode 1 [.3.1 ]** |
| | | Long [SET] | [Set Enable]: set this Auto Power ON/OFF enable or disable: 0(Disable)/1(Enable); |
| | | [SET] | [Set Turn On Hour]: set auto turn on hour in [00~23]; |
| | | [SET] | [Set Turn On Minute]: set auto turn on minute in |

| | | | |
|---|---|---|---|
| | | | [00~59]; |
| | | [SET] | [Set Turn Off Hour]: set auto turn off hour in [00~23]; |
| | | [SET] | [Set Turn Off Minute]: set auto turn off minute in [00~59]; |
| | | [SET] | [Nixie Brightness]: 0(Auto-Brightness)/[1~8]for brightness(8 is the brightest); |
| | | [SET] | Goes to next Mode |
| | [+] | | **Auto Power ON/OFF Display Mode 2 [.3.2 ] (Set options same as above)** |
| | [+] | | **Auto Power ON/OFF Display Mode 3 [.3.3 ] (Set options same as above)** |
| | [+] | | **Misc Mode [.4.]** |
| | | Long [SET] | [Set NIXIE Brightness]: 0(Auto-Brightness)/[1~8] for brightness(8 is the brightest); |
| | | [SET] | [Click Beep Enable]: 0(Disable)/1(Enable); |
| | | [SET] | [Set Beep Alert Style]:[0~3] for 4 different beep style; |
| | | [SET] | [Set Alarm Beep Loop Times]: in [05~99] range; |
| | | [SET] | [Set Font]:in [0~5] range; |
| | | [SET] | Goes to next Mode |
| | [+] | | **Version Display Mode [.5. 1.0.]** |
| | | Long [SET] | [IR Test Mode]: Shows the IR remoter code which you pressed. You can test your IR remote controller in this mode; |
| | | [SET] | [Reset All]: Set this number to [1], then click the [set] button, all the settings will be reset to the default, and the clock will auto reboot itself when finished. |

**[SET] = Left Button [+] = Right Button**

## Fonts List:

# The State Machine of NIXIE Clock V1.1