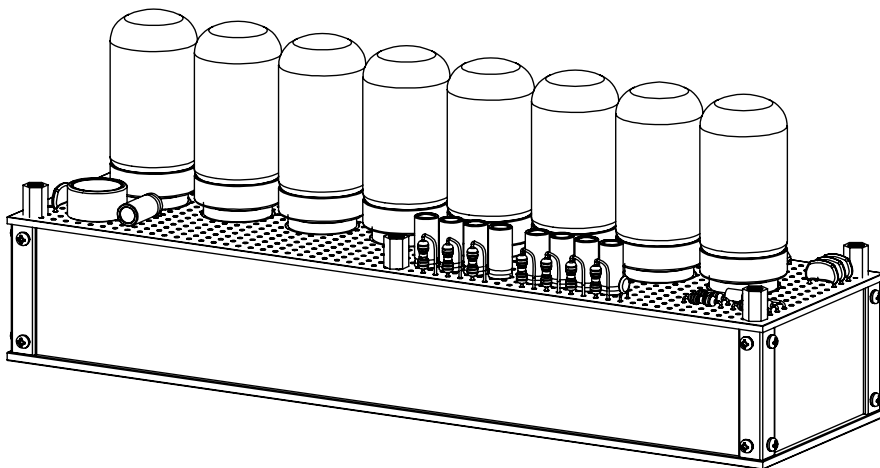


Divergence Meter

User manual v2.0.2



Designer: Yan Zeyuan. China
Website: <http://www.nixieclock.org>
E-mail: yanzeyuan@163.com

Attention

- ◇ Attention: To avoid accidental damage, do not place Divergence Meter on an uneven surface.
- ◇ Warning: The Divergence Meter has an internal high voltage circuit, do not open it or get in contact with the components while it is electrified.
- ◇ Warning: In order to ensure normal operation and charging, please use the included power adapter and USB cable.
- ◇ Warning: The Divergence Meter is for indoor use only.
- ◇ Warning: Keep the Divergence Meter out of the reach of children.

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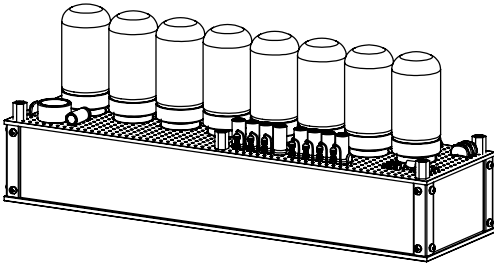
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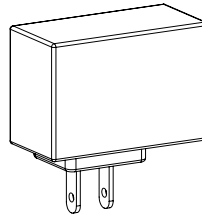
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Package Contents

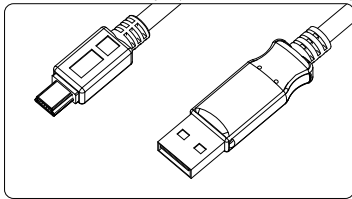
Before getting started, please check all the following items are received. In case any of them is missing, please contact seller immediately.



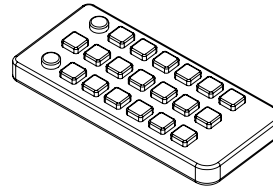
Divergence Meter



Power adapter



Micro-USB Cable

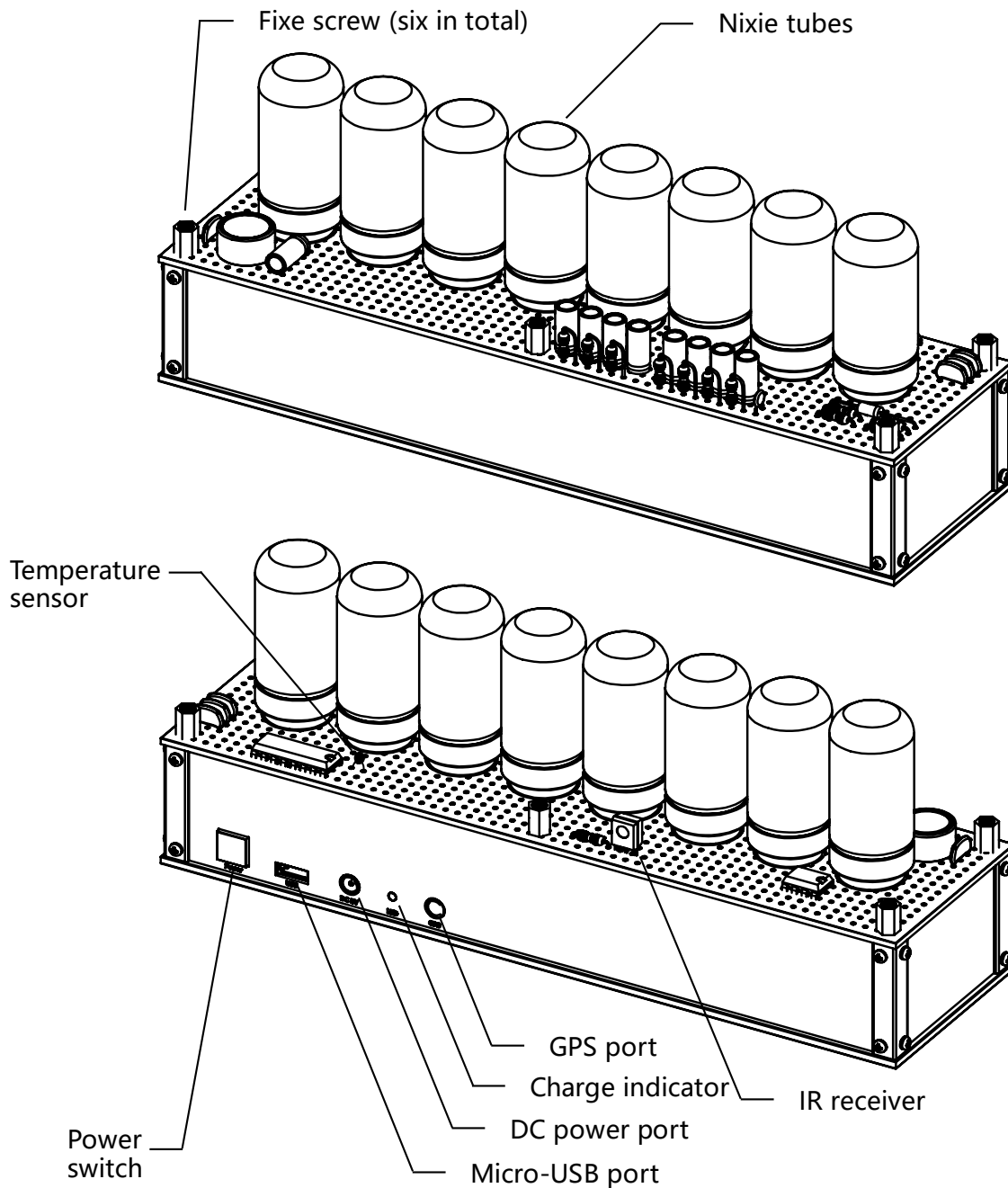


IR remote controller



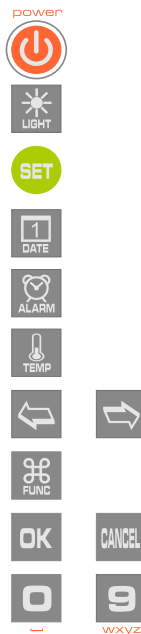
- The included power adapter has standard USB port, with a maximum output current of 2 Amp, which is capable of fast charging during normal operation. Do NOT use other USB power supply or USB cable, as they may not be able to supply sufficient current and therefore cause problems.

Appearance



- Three variations were designed for Divergence Meter with different tubes, which have different appearance.
- EDGE version uses NL-5440A made in the USA.
- Plus version uses IN-8-2 Nixie tubes made in Soviet Union.
- Pro version uses IN-14 Nixie tubes made in Soviet Union.

IR Remote

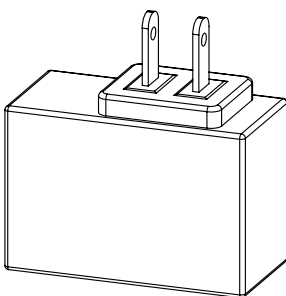


Power	Power ON/OFF
LIGHT	Talking clock
SET	Enter setup
DATE	Check date
ALARM	Display alarm
TEMP	Display temperature
LEFT/RIGHT	Set position
FUNC	Enter menu
OK/CANCEL	Save / exit
NUMBER	Input numbers



- IR controller uses (1) CR2025 cell battery. Transportation rules may not permit shipment with lithium battery installed. Please check the battery before operate.
- Please remove protective insulator to operate.

Power Adapter



- Input: 100-240V AC, 0.4A 50/60Hz.
- Output: Standard USB port, DC 5V, 2A max.



- In order to ensure security and charging efficiency, please only use the power adapter and USB cable provided.

Features

Divergence Meter has the features of Steins;Gate with animation effects. In addition, Divergence Meter is a full-featured Nixie clock.

- **Nixie clock with eight Nixie tubes**
The EDGE version uses NL-5440A Nixie tubes made in USA; The Plus version uses IN-8-2 Nixie tubes made in Soviet Union; The Pro version uses IN-14 Nixie tubes made in Soviet Union.
- **Real-time clock display**
Display hour, minute and second (12 or 24 hour format) with leading zeroes (can be enabled/disabled). Two different time display mode: Normal 6 digits mode and Divergence Meter mode. e.g.: 22:15:20 can be displayed as either 22.15.20 or 1.101520.
- **Date display**
Display year, month, day and Chinese lunar date (YY-MM-DD, YY-DD-MM, DD-MM-YY or MM-DD-YY format optional).
- **Alarm**
Four alarm clocks, each of which can be activated individually (weekend activated optional).
- **Temperature display**
Built-in temperature sensor(°C or °F).
- **Talking clock**
Intelligent speech system in English, Chinese Mandarin, Japanese, German. The interval and alarm music can be customized by user.
- **Volume adjustable**
8 volume levels.
- **Animations as show in the comics**
Up to 10 sets of Divergence data can be saved. The transitions among them have animations.
- **Animations show with music**
Divergence data is shown along with built-in music.
- **Four transition effects for the digits**
1. Normal 2. Fade in-out 3. Crossfading 4. Slot machine.
- **Ten transition speed for the digits**
Ten speeds available for the transition.
- **Four animation effects for the colons**
1. Left and right dot crossfading 2. Left and right dot fade in-out 3. Always lighting 4. Blinking.
- **GPS synchronization**
Synchronization with GPS satellites. GPS module required. (NOT included)
- **Automatic Power On/Off**
Power On/Off time can be set to prolong the tube lifespan.

Technical Specifications

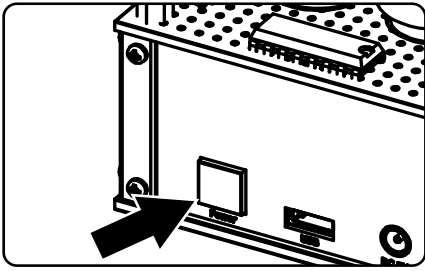
Name	Specifications
Nixie tubes	EDGE edition: NL-5440A made in USA
	Plus edition: IN-8-2 made in Soviet Union
	Pro edition: IN-14 made in Soviet Union
Power input	Micro-USB or DC(3.5mm/1.35mm)
Voltage of Micro-USB input	DC 5V
Voltage of DC input	DC 5V
Operation current	Max 900mA (for display only)
	Max 1000mA (for charging only)
	Max 1900mA (for display and charging)
Built-in battery	2pcs Panasonic NCR18650B (capacity 6800mAh)
	Run time per charge: 8-10 hours
	Time of charging: 6 hours
GPS requirement	TTL port, 2400-9600bps, 3.5mm headset plug
Dimension	Base 190mm(L) x 50mm(W) x 35mm(H)
	Height of nixie tube 55mm, diameter 19mm
Material of housing	Stainless steel
Operating temperature	0°C to 60°C (32°F to 140°F)
Weight	600g (Divergence Meter Only)
	1200g (Divergence Meter with the package)



- Run time of battery may vary with the environment temperature and operation mode.
- Time of charging depends on the remaining capacity before charging.

Get Ready Before Use

Power On/Off



- Turn on the power by press the power button on the back.
- The lamp in the button will turn red when power is on.
- Turn of the power by press again.

Charging the Battery

- Divergence Meter can operate for 8-10 hours of continuous use with the built-in 18650 Lithium batteries.
- Run time of batteries may vary with the environment temperature and operation mode.
- Please fully charge the battery before use.
Color code of indicator during charging:

LED Color	Status
Red	Charging
Green	Fully charged
Off	Charging protection

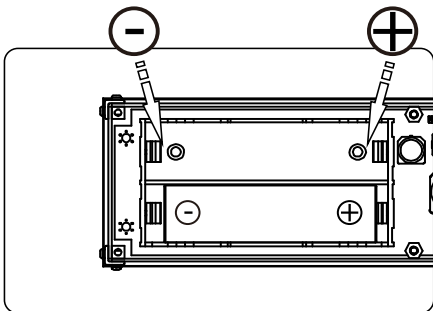
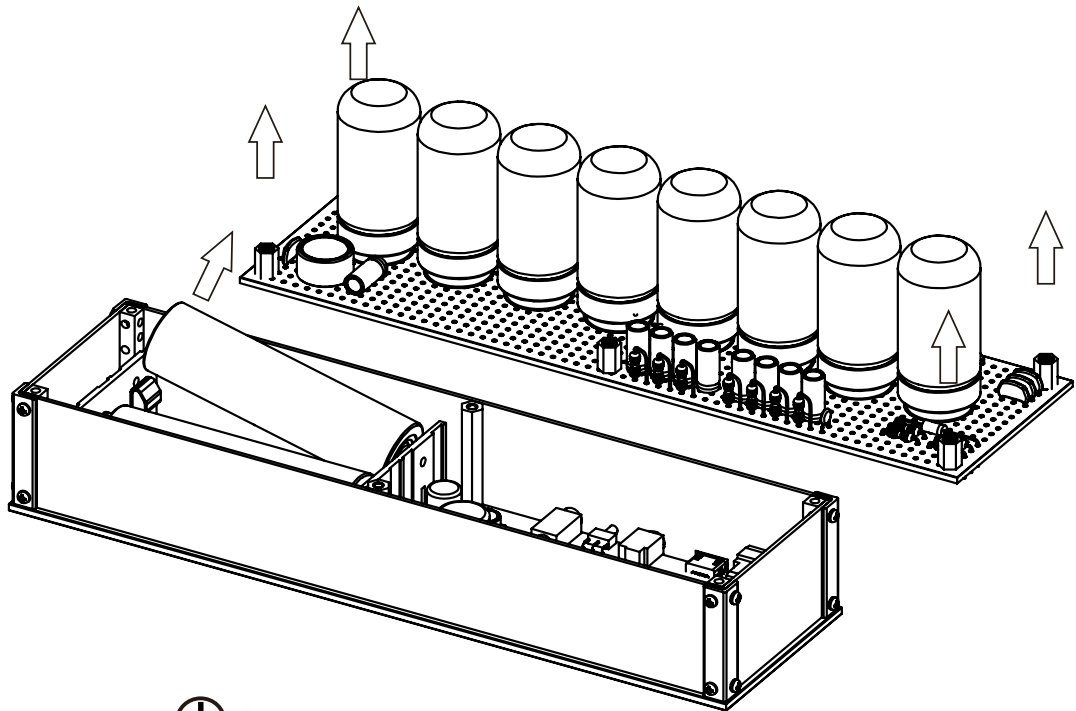
- Charging will take about 6 hours at room temperature. Fully charged time depends on remaining capacity before charging.



- Divergence Meter has 2pcs Panasonic NCR18650B 3400mAh lithium batteries installed.
- It is recommended to turn off the power for fast charging.
- The indicator will turn green after the charging is completed. It is not necessary to unplug the charger after charging is completed. In this case, the charger will power the Divergence Meter directly.

Replace Batteries

- Please remove 6pcs top screws and top unit before replace batteries.
- Pull up the belt under batteries to remove them, then install new batteries.



Please pay attention to the anode and cathode when install the batteries.



- Incorrect polarity will lead to serious consequences. Please follow instruction picture above.



- Please use two batteries with same capacity.

Connect a GPS receiver (**GPS receiver is not included and available for purchase separately**)

GPS receiver can synchronize the date and time with satellite.

- It is highly recommended to only use the GPS receiver (with 3.5mm plug) sold from us.
- Please plug in the GPS receiver from the back of Divergence Meter.
- Please place the GPS receiver outdoor or close to the window for better reception.
- The connection status can be checked in MENU 9.



- GPS requires TTL interface and follows NMEA0183 protocol.
- The Divergence Meter uses baud rate of 2400bps, 4800bps, 9600bps while communicating with the GPS receiver.

Cleaning

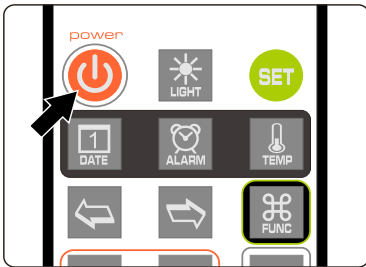
The notes below should be considered before cleaning Divergence Meter.

- Please power off and disconnect USB cable before cleaning.
- Do not use any cleaning agent or wet wiper.
- Soft cloth or brush is suggested to prevent scratching the housing.

Basic Operations

Soft Power On/Off

After power on by press power button on the back of Divergence Meter, it can be power on/off by press **POWER** button of IR remote controller.



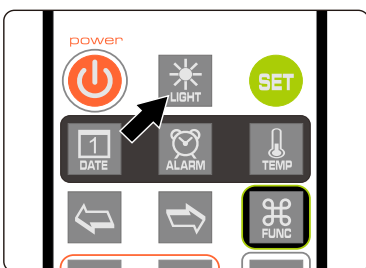
- Press **POWER** button on the IR remote to power off.
- Press **POWER** button again to power on.



- Soft power-off only turns off the display of Nixie tubes. Please press the power button on the back if you want to power it off completely.
- To set sound effect of power on, please consult MENU 18.
- To set animation of power on, please consult MENU 19.

Talking Clock

The Divergence Meter can work as a talking clock.



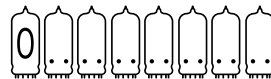
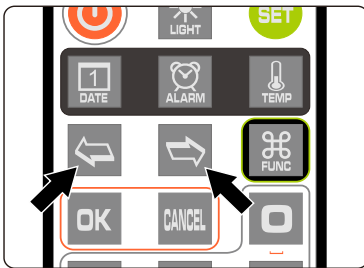
- Press LIGHT button on the remote to activate the talking clock.
- Automatic talking clock as a time interval can be set following MENU 16.



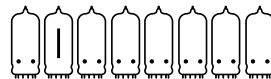
- Talking clock can be triggered any time.
- Built-in speech system has 4 languages, including English, Chinese Mandarin, Japanese, and German. Consult MENU 15 for more details.
- The volume of talking clock is set by the system volume.

Set Volume

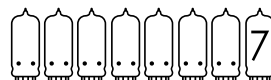
The volume of talking clock or other sound effect has eight levels available.



Mute



Minimum volume



Maximum volume

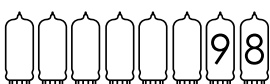
- Press **LEFT/RIGHT** button to set volume.



- This volume setting only for talking clock and sound effect during operating. The volume of alarms is independent to this.
- To set volume of alarms, please consult MENU 14.

Checking Batterypercent

After press POWER button of IR remote to power off, Divergence Meter will show the batterypercent.



- Digits will show the batterypercent on right three tubes.
- Divergence Meter will sound alert every minute when the batterypercent under 20%.

Animations with Music

Divergence Meter can show animation with built-in music.



- Press **OK** button start animation show.
- Press **CANCEL** button to stop.

Display Divergence Data from the Comics

Divergence Meter can save up to 10 sets of Divergence data. Press 0-9 button to show.

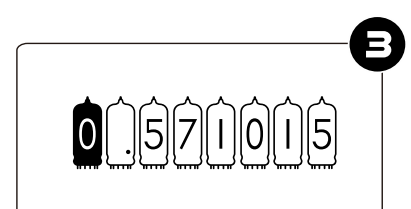
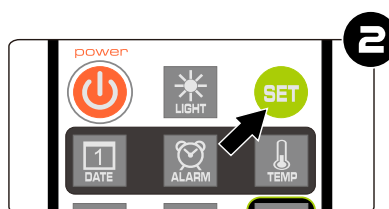


Default divergence data:

0:	0.337187	5:	1.130238
1:	0.571015	6:	1.048596
2:	0.523307	7:	0.456903
3:	0.571024	8:	0.275349
4:	2.615074	9:	1.130426

Modify the Stored Divergence Data

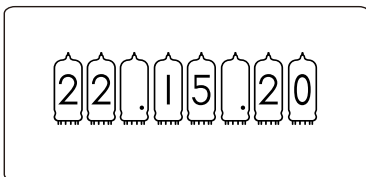
- Please press **0-9** button to select the number of divergence data, then press **SET** button to enter the new value. Then the number on the left will blinking.
- Press **0-9** button input 7 digits to change divergence data.
- All digits will blink three times after the input is completed.
- Press **CANCEL** button to abort.



Display Time

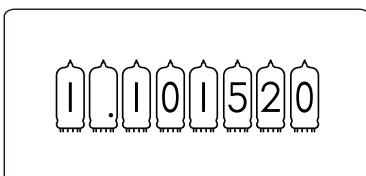
- Divergence meter will display current time after power on.
- There are two time display mode: Normal 6 digits mode and Divergence Meter mode.

e.g.: now time is 10:15:20 PM, the Divergence Meter will display:



Normal 6 digits mode

- In normal mode: digits on the left are HOUR, digits in the middle are MINUTE, digits on right are SECOND.
- Colon display will following effect settings.



Divergence Meter mode

- In Divergence Meter mode: digits on the left will show AM(0) or PM(1), and the 6 digits on the right will show you HHMMSS.

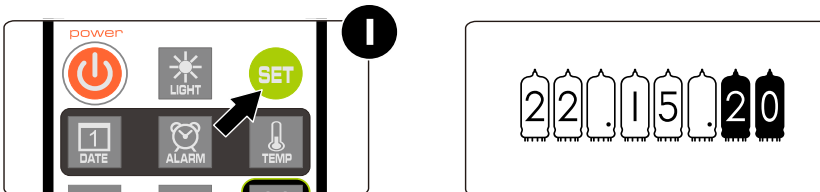


- In normal mode, to set 12/24 time format please consult MENU 1.
- In normal mode, to set leading 0 please consult MENU 4.
- To set digital switching effect, please consult MENU 5.
- To set digital switching speeds, please consult MENU 6.
- In normal mode, to set colon effect, please consult MENU 7.

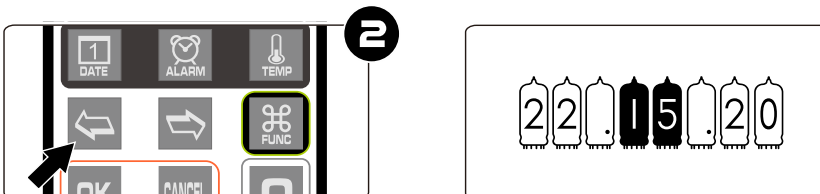
Set Time

Time can be set manually or synchronize with satellite through GPS receiver module (not included). How to set time manually:

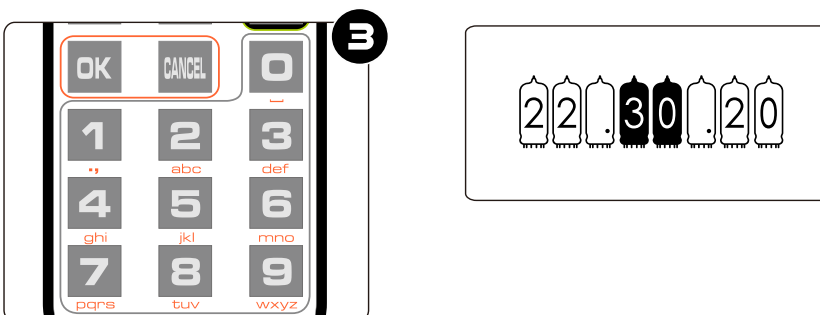
- Press **SET** button to enter time setting mode, 2 digits on the right start blinking.



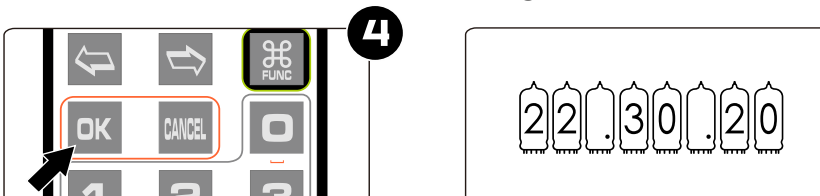
- Press **LEFT/RIGHT** button select position of setting.



- Press 0-9 button input HOUR, MINUTE or SECOND.



- Press **OK** button to save settings or press **CANCEL** button to abort.



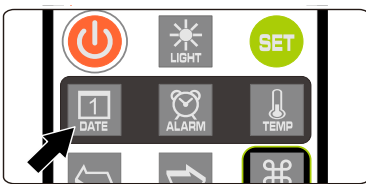
- Time will display in 24 hour mode HH:MM:SS in setting mode.
- Any digits can be input during setting, but system will check if the time is valid when it is saved. Invalid time can not be saved.

Display Date

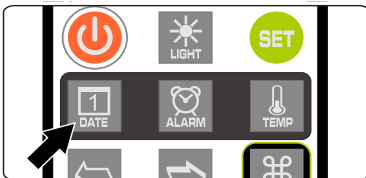
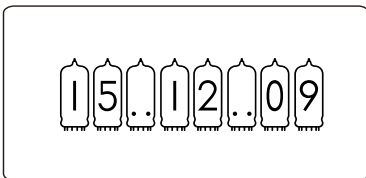
Divergence Meter can display year, month and day and Chinese lunar date.

- Press **DATE** button to display date; press twice to display Chinese lunar date.

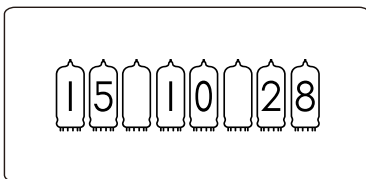
e.g.: If today' s date is 9th Dec 2015, and Chinese lunar date is 2015-10-28.



- Press **DATE** button, it will display 2015-12-09
- The 3rd and 6th digits will display two dots to indicate it is showing Wester Date. (as opposed to Chinese Lunar date)



- Press **DATA** button twice, it will display 2015-10-28.
- The 3rd and 6th digits will not light up while display Chinese lunar date.

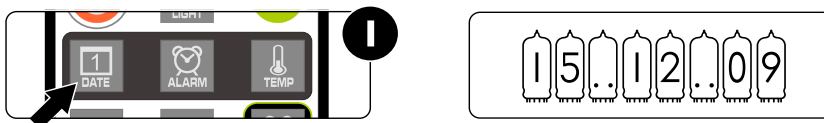


- After 3 seconds of display date, Divergence Meter will return to time display mode.
- The plus version only has one dot in the nixie tube, so it will display only one dot during date display.
- Date format can be set to YY-MM-DD, YY-DD-MM, DD-MM-YY or MM-DD-YY. Please consult MENU 2.

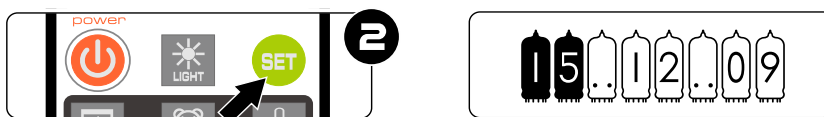
Set Date

Date can be set manually or synchronize with satellite with the optional GPS receiver. (not included). How to set date manually:

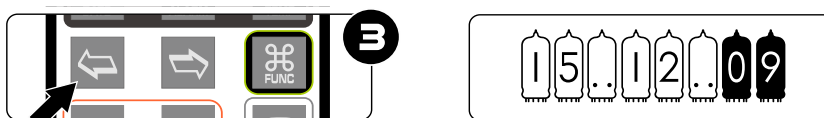
- Press **DATE** button to show the date.



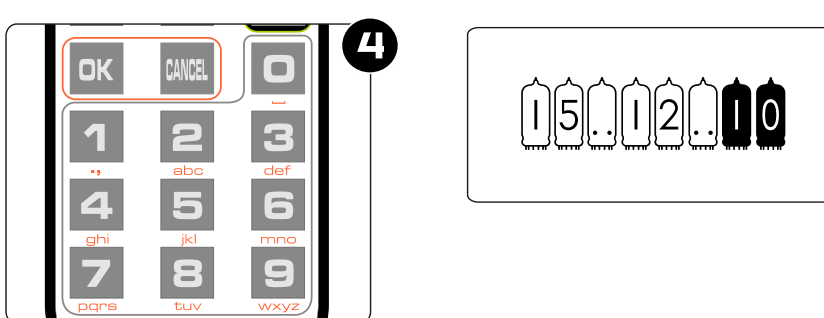
- Press **SET** button to enter set date mode, The 2 digits on the left start blinking.



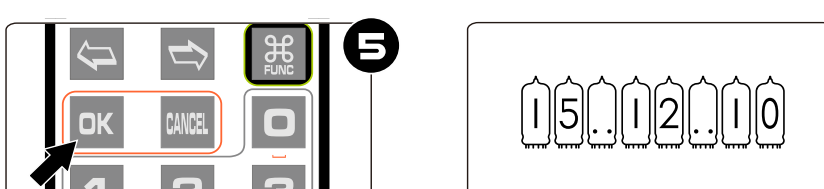
- Press **LEFT/RIGHT** button to select setting position.



- Press **0-9** button to enter YEAR, MONTH or DAY.



- Press **OK** button to save setting, press **CANCEL** to abort.



- In setting mode, the date format will be YY-MM-DD.
- Any digits can be input during setting, but system will check if the date is valid when it is saved. Invalid date can not be saved.
- The system will calculate Chinese lunar date automatically based on the Western date.

Display Alarms

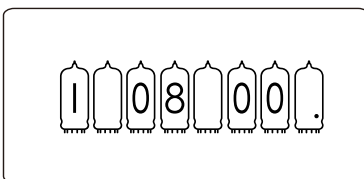
Divergence Meter supports 4 alarms, which can be activated separately (weekdays and weekend).

- Press **ALARM** button to check alarm 1, and press **ALARM** button again to check alarm 2, and so on.

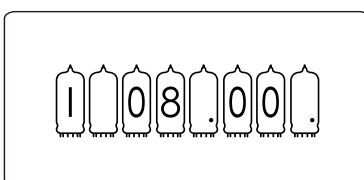
e.g.: alarm 1 is set to 8:00 AM.



- Press **ALARM** button to display alarm 1, which is 8:00 AM.



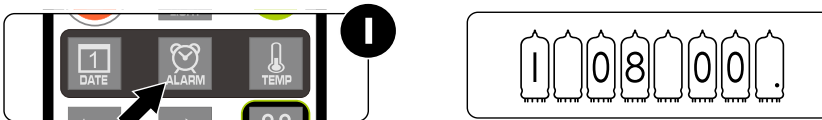
- Press **FUNC** button during display alarm to enable the alarm. When the alarm is activated, the 5th tube will display dot. Press **FUNC** button again to disable alarm, and the 5th tube will not display dot.
- Tube on the rightmost will show you if alarm is enabled on weekends. (dot on means enabled; dot off mean disabled.)



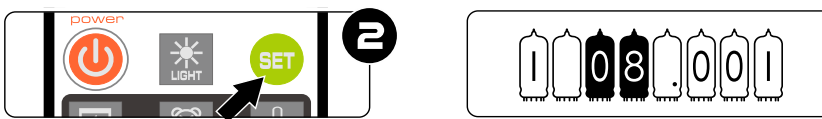
- Divergence Meter will return time display mode after display alarm for 3 seconds.
- To set the volume of alarm, please consult MENU 14.
- To enable/disable alarm on weekends, please consult SET ALARM.

Set Alarms

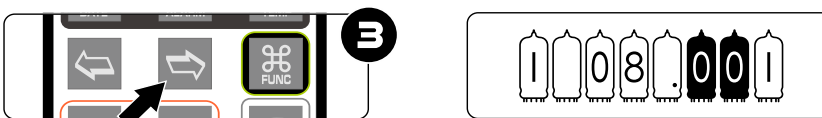
- Press **ALARM** button to select alarm. The digit on the leftmost will show alarm number.



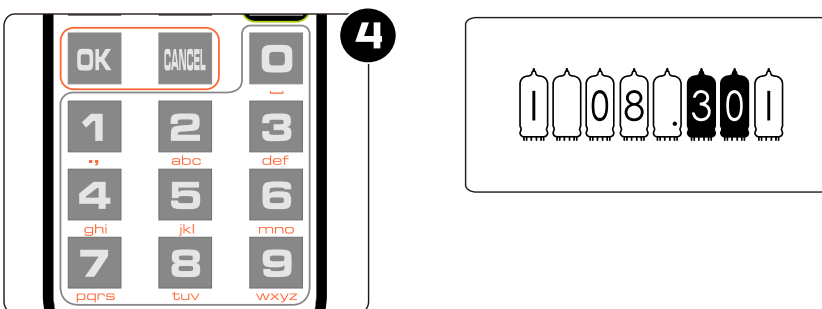
- Press **SET** button to enter alarm set mode. The HOUR will be blinking.



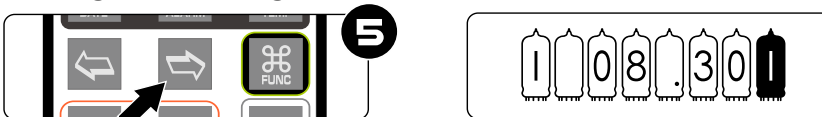
- Press **LEFT/RIGHT** button to select setting position.



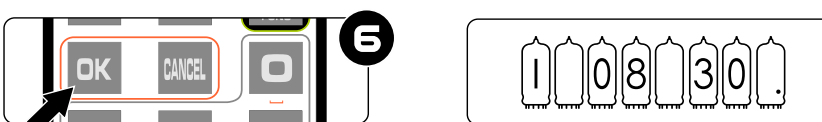
- Press 0-9 button to input HOUR or MINUTE.



- Digit on the rightmost: 1 means alarm enabled at weekend; 0: means disabled.



- Press **OK** button to save setting or press **CANCEL** to abort.

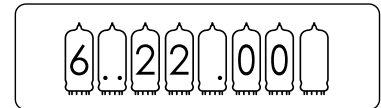
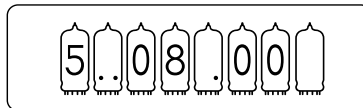


- System will check if alarm time is valid when setting is saved, invalid alarm can not be saved.
- The digit on the rightmost can only set to 0 or 1.
- To enable alarm, please consult DISPLAY ALARMS.

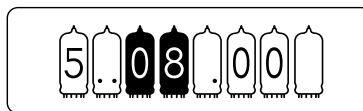
Set Auto On/Off Time

- Press **ALARM** button 5 times to display AUTO ON time, and press 6 times to display AUTO OFF time.

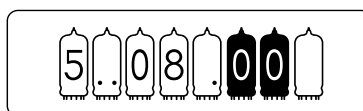
e.g.: AUTO ON time is set to 8:00 AM, AUTO OFF time is set to 10:00 PM.



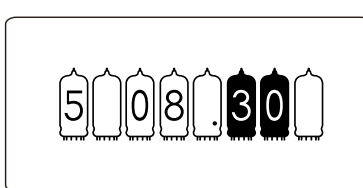
- Press **SET** to enter auto power on/off time setting mode. The HOUR starts blinking.



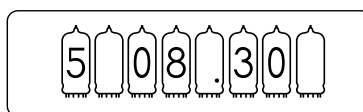
- Press **LEFT/RIGHT** button to select setting position.



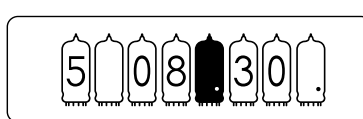
- Press 0-9 to input HOUR or MINUTE.



- Press **OK** button to save setting or press **CANCEL** to abort.



- The 5th digit will indicate if the auto on/off feature is enabled or disabled. Press **FUNC** to toggle on/off.

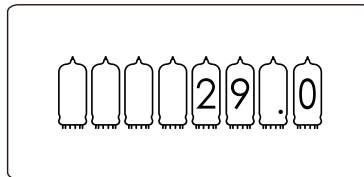


- System will check if auto on/off time is valid. Invalid time will not be saved.
- System will check if it is in auto on/off time every minute.

Display Temperature

Divergence Meter can display indoor temperature with the built-in temperature sensor.

- Press **TEMP** button to display the current temperature.



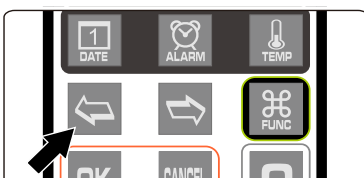
- Divergence Meter will return to time display mode after 3 seconds.
- Temperature unit can be set to °C or °F. Please consult MENU 3.
- Temperature compensation can be set from -5°C to 5°C, please consult to MENU 12.

Menu

20 items in the menu are available to set system parameters.



- Press **FUNC** button to enter menu.



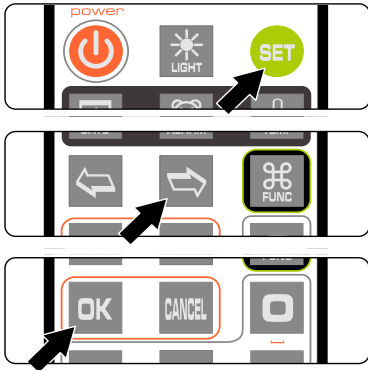
- Press **LEFT/RIGHT** to select menu items.
- Press **SET** button to save current menu item.



- Divergence Meter will return to time display mode after 3 minutes if no operation occurs in the menu.

Menu Setup

There are 20 items in the menu to set parameters.



- Press **SET** button to enter setting mode.
- Press **LEFT/RIGHT** button to change setting position.
- Press **OK** to save setting.
- Press **CANCEL** to abort.

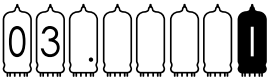
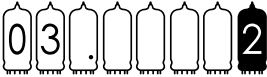
Menu 1 Set Time Format

Display	Parameter	Remarks
01.24 1	24 hour	Default
01.12 2	12 hour	

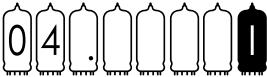
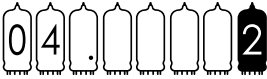
Menu 2 Set Date Format

Display	Parameter	Remarks
02. 1	YY-MM-DD	Default
02. 2	YY-DD-MM	
02. 3	DD-MM-YY	
02. 4	MM-DD-YY	

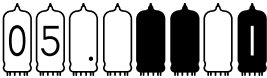
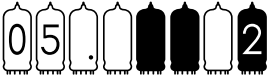
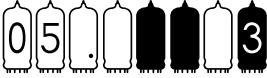
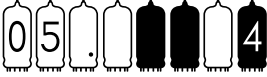
Menu 3 Set Temperature Format

Display	Parameter	Remarks
	°C	Default
	°F	

Menu 4 Set Leading Zeroes

Display	Parameter	Remarks
	On e.g.: 08.00.00	Default
	Off e.g.: _8.00.00	

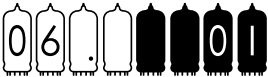
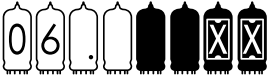
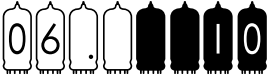
Menu 5 Set Digital Switching Effects

Display	Parameter	Remarks
	Normal	
	Fade in-out	
	Crossfading	Default
	Slot machine	



- The 5th and 6th tubes will demonstrate the effect during setting.

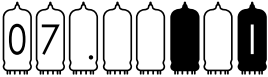
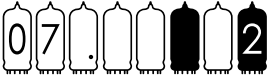
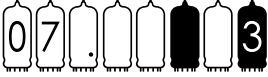
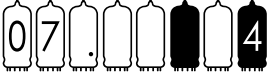
Menu 6 Set Digital Switching Speed

Display	Parameter	Remarks
	01 Fast	
	01-10 10 level in total	Default 07
	10 Slow	



- The 5th and 6th tubes will demonstrate the switching speed during setup.

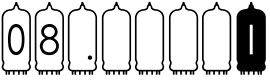
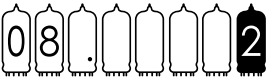
Menu 7 Set Blinking Colon Effect

Display	Parameter	Remarks
	Left and right dot crossfading	Default
	Left and right dot fade in-out	
	Always on	
	Blink every 2 seconds	

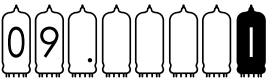
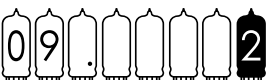


- The 6th tube will demonstrate the colon blinking effect during setup.
- The Plus edition will not display the left dot.

Menu 8 Set Time Display Mode

Display	Parameter	Remarks
	Normal 6-digits mode	Default
	Divergence Meter mode	




Menu 9 Set Clock Reference Source

Display	Parameter	Remarks
	RTC (built-in Real Time Clock)	
	GPS	Default

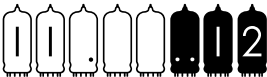
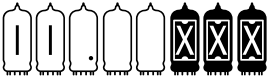
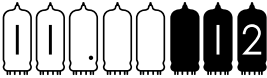


- To use GPS as the reference, a GPS receiver must be connected. The GPS receiver is not included, and is available from purchase separately.
- The 5th-7th tubes will display connection status after connected. No display means no GPS connection. Dot rolling means connecting to GPS. Dot blinking means GPS connected.

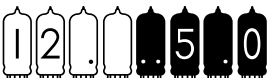

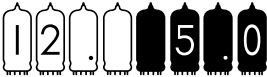
Menu 10 Set Baud Rate of GPS

Display	Parameter	Remarks
	2400bps	
	4800bps	
	9600bps	Default

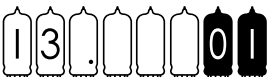
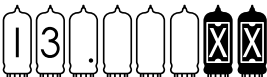
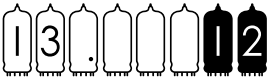
Menu 11 Set UTC Time Zone

Display	Parameter	Remarks
	UTC-12	
	UTC+12 to UTC-12	Default UTC+8
	UTC+12	

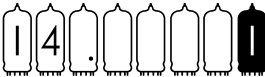
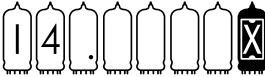
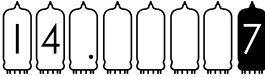
Menu 12 Set Temperature Compensation

Display	Parameter	Remarks
	-5°C	
	-5°C to 5°C	Default 0°C
	5°C	

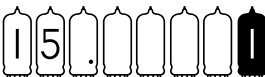
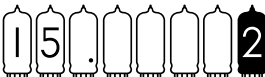
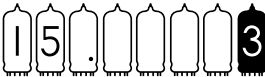
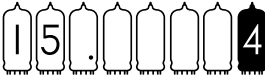
Menu 13 Set Alarm Sound

Display	Parameter	Remarks
	No.1	Default
	No.01 to No.12	
	No.12	

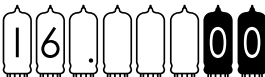
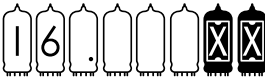
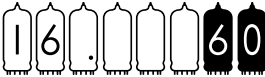
Menu 14 Set Alarm Volume

Display	Parameter	Remarks
	Level 1 (minimum)	
	Level 1 to 7	Default level 5
	Level 7 (maximum)	

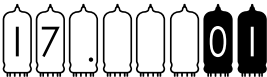
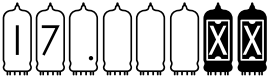
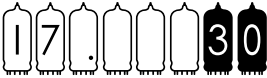
Menu 15 Set Talking Clock Language

Display	Parameter	Remarks
	Chinese Mandarin	Default
	English	
	Japanese	
	German	

Menu 16 Set Interval of Talking Clock

Display	Parameter	Remarks
	Talking clock disabled	
	Minute 0/1/2/3/5/10/15/20/30/60	Default 30 mins
	60 minutes (maximum)	

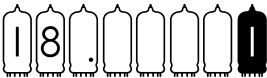
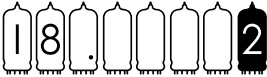
Menu 17 Set Interval of Divergence Animation

Display	Parameter	Remarks
	1 minute (minimum)	
	Minute 1/2/3/5/10/15/20/30	Default 10 mins
	30 minutes (maximum)	

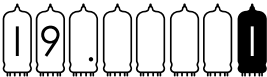
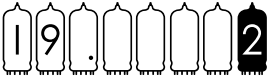


- Divergence animation can also prevent cathode poisoning of the Nixie tubes.
- About the cathode poisoning prevention feature, please consult the last page.


Menu 18 Set Sound Effect of Power On

Display	Parameter	Remarks
	Sound effect off	
	Sound effect on	Default

Menu 19 Set Animation Show of Power On

Display	Parameter	Remarks
	Animation off	
	Animation on	Default

Menu 20 Display Firmware Version

Display	Parameter	Remarks
	2.x.x	Firmware version

Firmware Upgrade

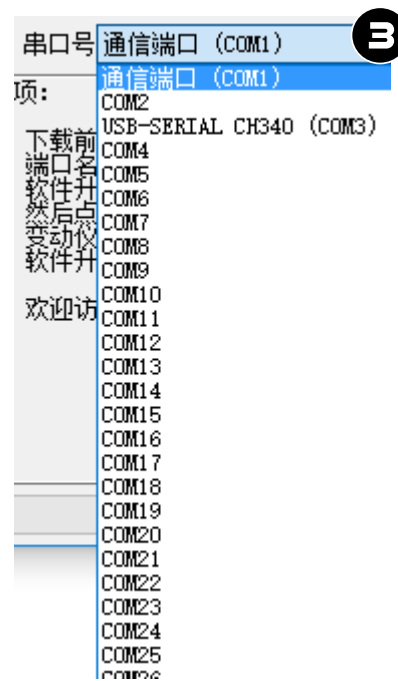
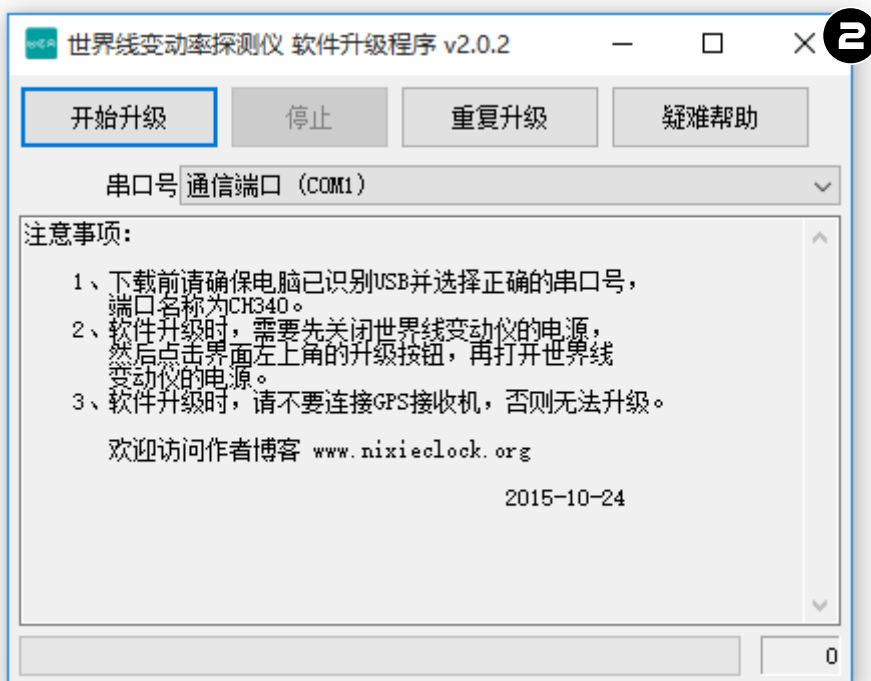
Firmware can be upgraded, whenever available, to fix certain problems.

Please download the latest firmware upgrade program and USB driver here:

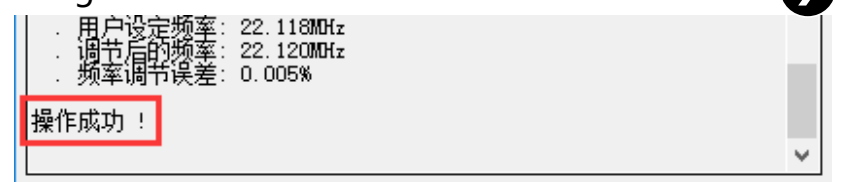
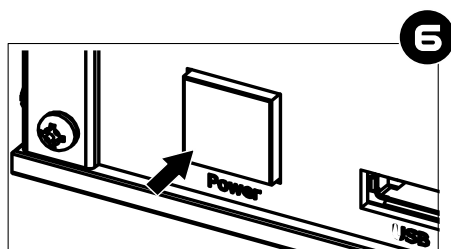
<http://www.nixieclock.org/?p=649>

Update operation steps:

1. Run the update software, as shown on the left.
2. The software interface is shown on figure 2.
3. Connect Divergence Meter to computer with the micro-USB cable provided.
4. Press power button on the back to power off.



5. Please select the serial port named **USB-SERIAL CH340** in the list after USB cable is connected. See figure 3.
6. Please install ch341ser driver (figure 4) if this serial port is not shown in the list.
7. Click **Update** button after serial port is selected.
8. Push the power button to power on. See figure 6.
9. Upgrade will start and take a few seconds. See figure 7.



Cathode Poisoning Prevention

All Nixie tubes suffer from 'cathode poisoning' causing metal molecules of glowing cathodes (digits) to attach to non-glowing cathodes. This finally leads to the end of tubes' life. To avoid this, the non/seldom glowing cathodes have to be switched on from time to time.

Divergence animation will light up all digits, shuffling through them. To use this feature, please refer to MENU 17. The default setting has 10 minutes interval. It is NOT recommended to disable this feature.

Special Remarks

- These nixie tubes were produced in 1960-1980. There may be minor differences/flaws among them, which is normal due to the limitation of the technologies at that time.
- Divergence Meter will become warm after a certain time of operation, which is normal.
- Divergence Meter is solid and heavy since its housing is made stainless steel. Please pay attention when plug/unplug the Micro-USB cable to avoid damage of Micro-USB socket.