AVHzY CT-2
USB Power Meter
User Manual
Rev V1.03

Welcome to use CT-2 USB power meter designed and provided by yanke928, this manual will lead you to use the device, please save the manual properly for looking up.

Hint: The model name can vary from one provider to another. So far, KT001, Kotomi Premium, CT-2, UT100 are provided, they have the same features and share the same manual, PC software and firmware, it is not necessary to concern about that.

Warning

It is a fatal mistake to operate the product as follows:

1. After high voltage triggered, the insertion of any device which has a maximum operating voltage below that high voltage may cause damage to the device plugged in.

2.When the power meter is monitoring the voltage & current on the two ports, DO NOT plug any device into the other ports, this will cause damage (Especially when the device being monitored required a high voltage) to the devices.

3.After using PD listener/trigger, or E-Mark Info Reader feature, please switch the PD tester switch back to OFF position for safer operation.

The author would not be responsible for any result of a faulty operation.

Revision History

7-8-2017: Initial release.

12-12-2017:

1. Revision version updated into V1.02, applicable for hardware version below V1.02, released when firmware version V1.79.0.
2. In warning page, added warning of PD tester switch switching back after use.
3. Section "Main Menu->Screen Settings", added manual for "HomePage Update Rate" and "Enable/Disable Fahrenheit".
4. Section "Auto Enumerate", added description for internal dummy load on hardware version V1.02 or above.
5. Added manual for trigger of Huawei SCP, VOOC/DASH.
6. Added manual for trigger of PD PPS.
7. Added manual for E-Mark Info Reader.
8. Added manual for cable resistance test mode "Bypass Load-Free".
9. Added new features in PD listener.

10. Section "Misc", added manual for logo customization, added improved method of theme customization.

12-27-2018

1.Revision version updated into V1.03, applicable for hardware version below V1.03, released when firmware version V1.79.3.

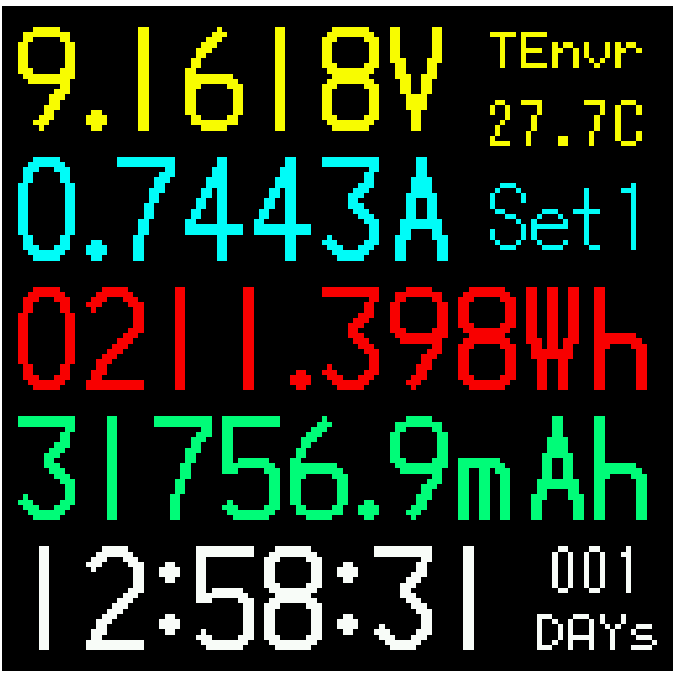
2.In Cable Resistance Test section. Remove mistaken "microUSB" test capability.

3.Section "E-Mark Info Reader", added description for E-Mark chip current comsumtion reading.

Structure

Home Screen

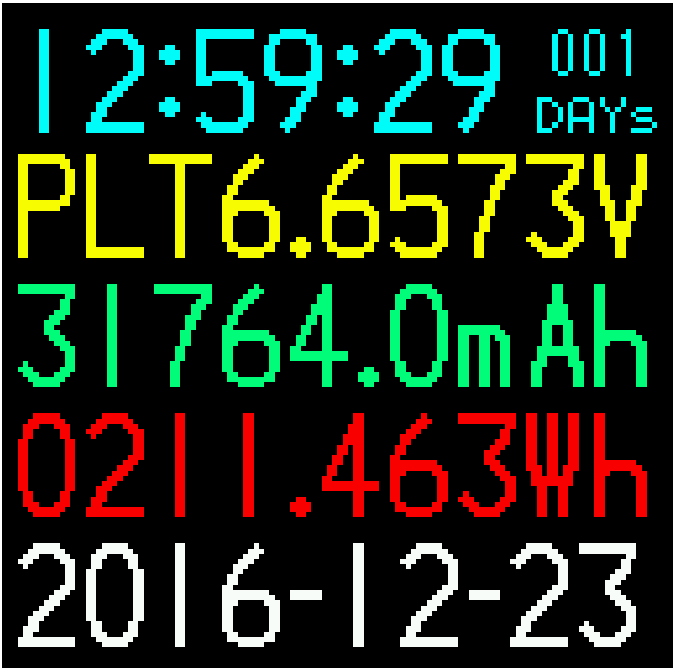
The home screen has **5** divided pages:



The **1st** page shows the **voltage** & **current** that the being-monitored devices are working at the time. The accumulated **energy** and **capacity** are shown below. Time, environment **temperature**, **data set number** are also shown in this page.

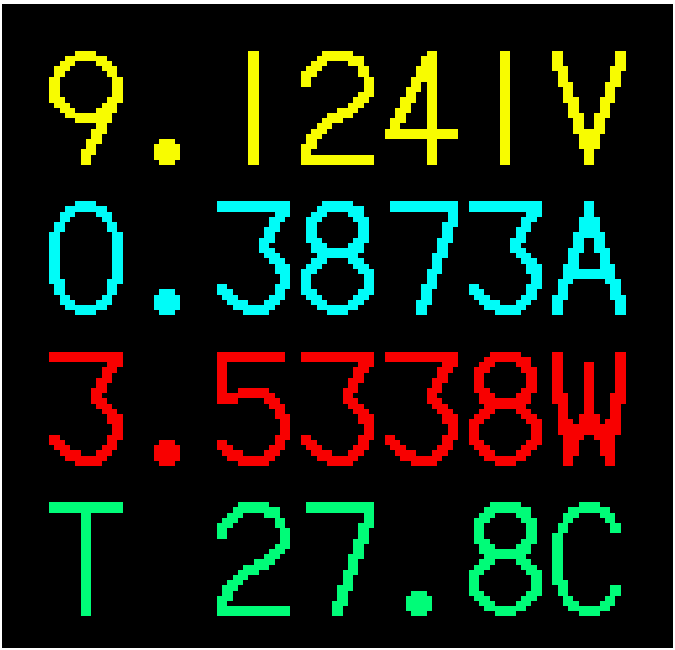
The **2nd** page shows the **voltages on D+ D- lines**, and the **protocol** that may working according to them. If a **PD** device is detected on the line, the PD indicator **turns on**, so as **QC**.

The **arrows** on the bottom of the screen indicates the **flowing direction** of the current(or energy) , **Voltage**, **current**, and **power** are also shown in this page.



The **3nd** page shows the **time**, **platform voltage**, **energy**, **capacity,** and **date**.

Note that the **platform voltage equals to energy divided by capacity**.



The **4th** page shows the **voltage**, **current**, **power**, and environment **temperature** in **big font**.

The **5th** page **turns the screen off**, usually to **reduce the power consumed by the meter itself to get higher precision**.

Menu

A **long press to the middle key** will make the system **enter the main menu**.

- **Switch Group**

The device keeps **5** groups of data, this can **switch from one to another**.

- **Clear This Group**

This will reset the data in the current group.

- **Time Settings**

This option sets the **time**, which will be shown on the **idle clock page**.

- **Record Threshold**

This option sets the **record threshold** of the device, the **capacity**, **energy**, and **time** keep **accumulating** when the **current** is **above** the **threshold**. The **current below the threshold** will be **ignored**.

- **Idle Clock Settings**

This option contains settings on **idle clock**.

When there is **no** operation on the device **for some time**, **and the current is below recording threshold**, system enters **idle clock mode**.

The **Idle clock time** can be set from **15s to 300s**, and **clock can be disabled**. If a **current above the threshold** is detected, system **exit** this mode and **enter home screen**.

•Screen Settings

This option contains settings of the **screen**.

Disable/Enable Screen Idle: After a given time **without operation**, screen **reduces brightness** to save power, this feature can disabled/enabled this option.

Screen Idle Time: This option sets the **time** that the screen turns idle.

Brightness Settings: This option sets the **brightness** when the device is **in operation**.

Idle Brightness: This option sets the **brightness level** when the screen is in idle mode.

HomePage Update Rate: Set update rate level of home-page.

Enable/Disable Fahrenheit: Enable or disable temperature display in fahrenheit.

•Personalized

The device has some features on personalization.

Theme Color: The theme color is the UI color such like dialogues, menus, etc. This option sets that color.

Enable/Disable Custom Theme: This enable or disable the custom theme.

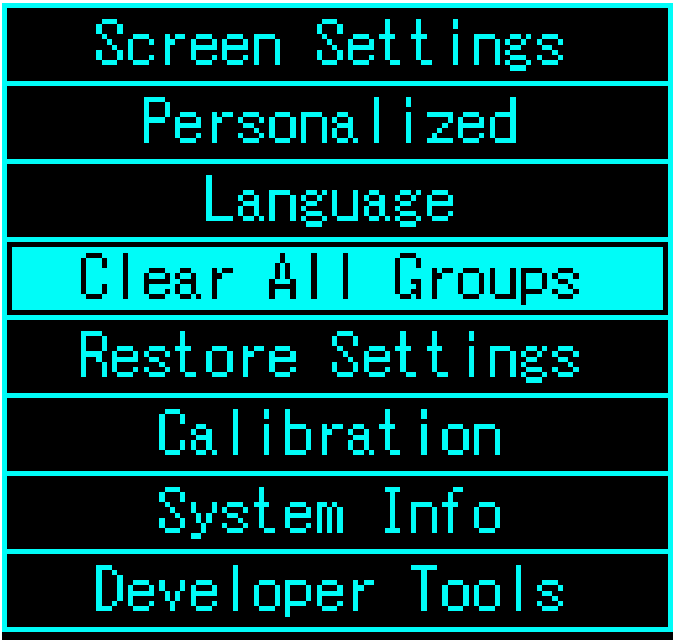
The guide of theme customizing is written at the **end of the manual**.

•Language

Set the **language**.

•Clear All Groups

Clear **all** data sets in one time.



- **Restore Settings**

  Restore settings to **default**.

- **Calibration**

  The user shall **not** enter this option.

- **System Info**

  See the software version, author, and vendor.

- **Developer Tools**

  The user shall **not** enter this option.

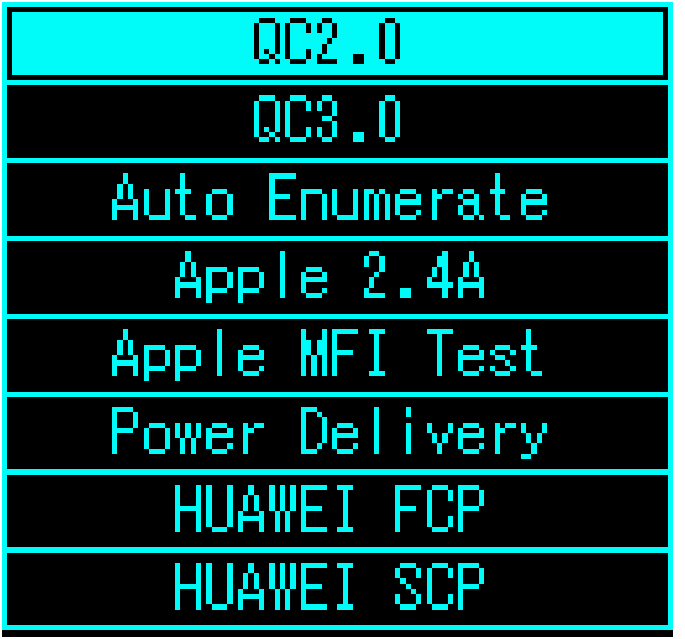
FastCharge Trigger

The device supports the triggering of **QC2.0/QC3.0, Apple 2.4A, PD, HuaWei FCP, Samsung AFC**, and contains the **auto detect routine** of the protocols above. The device also
provides a routine which can detect if an apple cable is MFI authorized(Reference only).

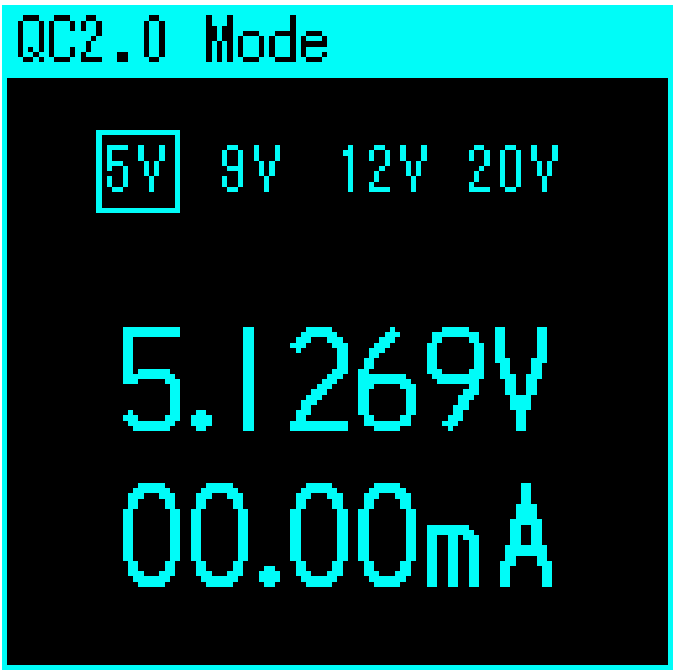
- **Warning**

The faulty operation of this feature may cause damage to the devices. The author isn't responsible for those consequences.

A **left click** on the home screen will make the system enter fast-charge trigger mode.


QC2.0
QC3.0
Auto Enumerate
Apple 2.4A
Apple MFI Test
Power Delivery
HUAWEI FCP
HUAWEI SCP

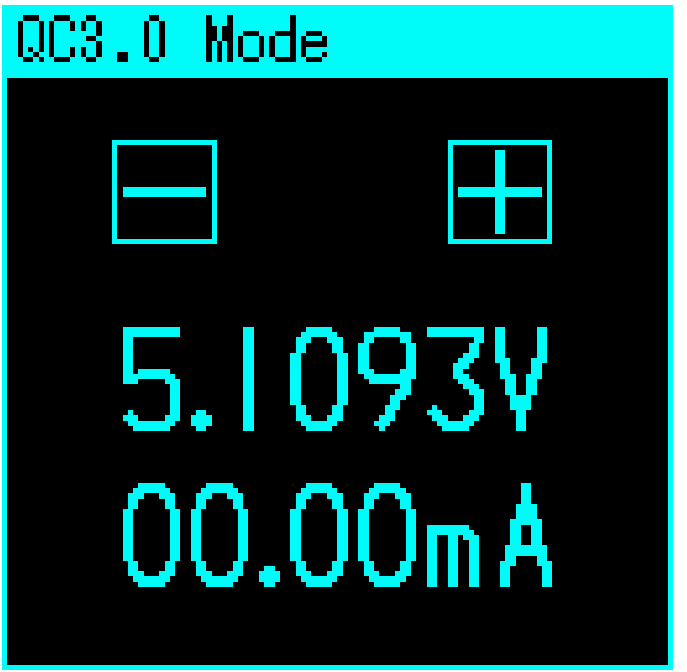
- **QC2.0**



In the QC2.0 mode, the user select the voltage wanted to be triggered by **scrolling the left and right keys**. A **click on the middle key** is recognized as **confirmation**.

A **double click on the middle key** will lead the system to **exit** this mode back to the home screen. The voltage **keeps** the level that the user required **after exiting this mode**.

- **QC3.0**

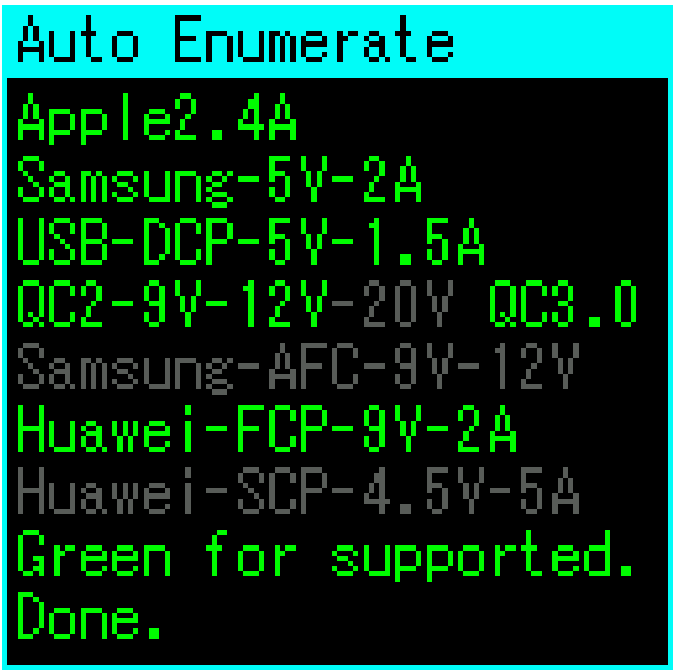


In the QC3.0 mode, the user adjust the voltage by **scrolling the left and right keys**.

Every click will have an effect of **200mV** according to the protocol.

A **double click on the middle key** will lead the system to **exit** this mode back to the home screen. The voltage **keeps** the level that the user required **after exiting this mode**.

- **Auto Enumerate**



In auto enumerate mode, the device will try **full sequence of the protocols**, and show the protocol is supported or not. During the process, **don't plug-in** any other device except the being-tested adapter/powerbank.

•Apple 2.4A

This will apply apple recognization voltages on D+ D- pins to **accelerate** charging on **apple** devices.

•Apple MFI Test

This is an apple MFI test routine which can detect if an apple cable is **MFI authorized**. Note that the result is **for reference only**.

During the procedure, the device will require **high volltage** from the **QC3.0** adapter, this may cause **damage** to the **unauthorized cable**.

The user shall plug the meter into an adapter which is **QC3.0 supported**, and plug in the **cable** into the **USB female**, then begin the test. Do not plug-in any other device during the procedure.

Wait for a few seconds.

Result "**Passed**" indicates the cable **is MFI authorized**.

Result "**Fake**" indicates the cable **is not MFI authorized**.

Result "**Unknown**" indicates the test **cannot be done correctly**, it is most probable that the adapter **is not QC3.0 supported**.

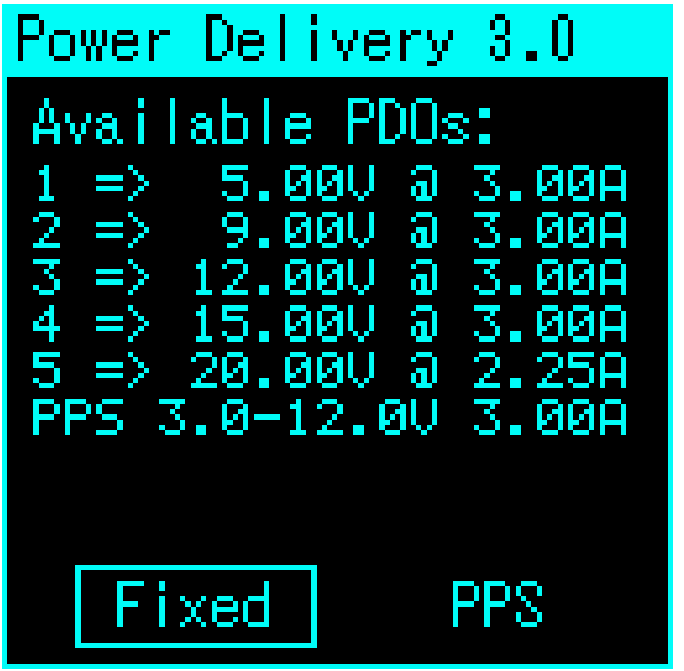
•Power Delivery 2.0/3.0

The meter has the feature of PD(Power Delivery) requesting. To avoid influence to the communications between the adapter and the phone, this feature **shall be disabled** when not used**.**

The user can **enable** this feature by toggling the **switch on the right bottom side** of the device to "**ON**" position, and **disable** it by toggling it to "**OFF**".

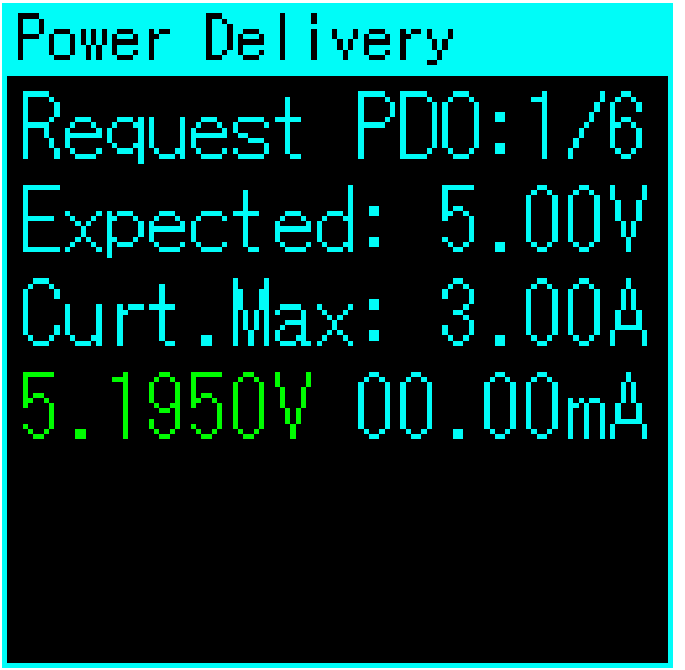
After enabling this feature, plug the meter to the adapter by a Type-C 2 Type-C cable. The meter will startup, then the user enter power delivery mode, the meter will **reset the adapter and itself**, after reset, the meter will **report the capability of the adapter**.

You can also enter this mode **rapidly** by **pressing and hold middle key during startup**.

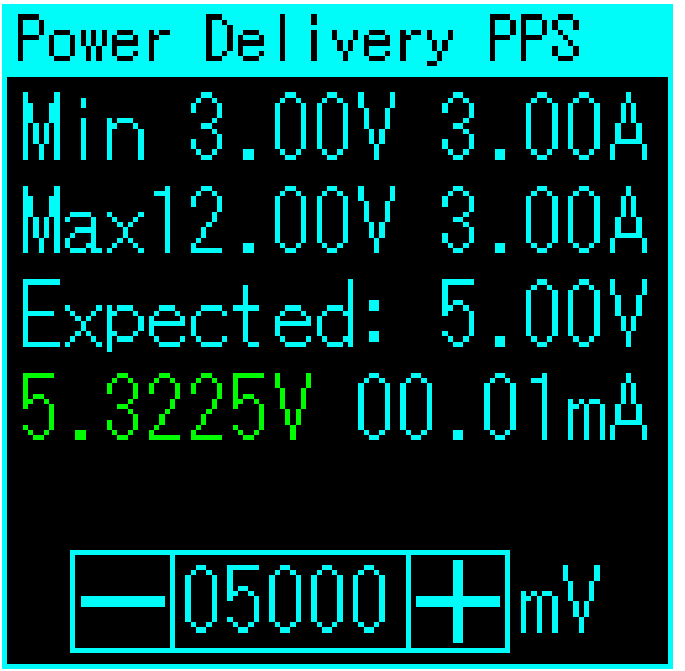


The example report is shown above.

This charger has support for PD revision 3.0, with 5 sepeate fixed PDO and 1 PPS PDO, select "Fixed" to trigger fixed PDOs, and "PPS" to trigger PPS PDO.

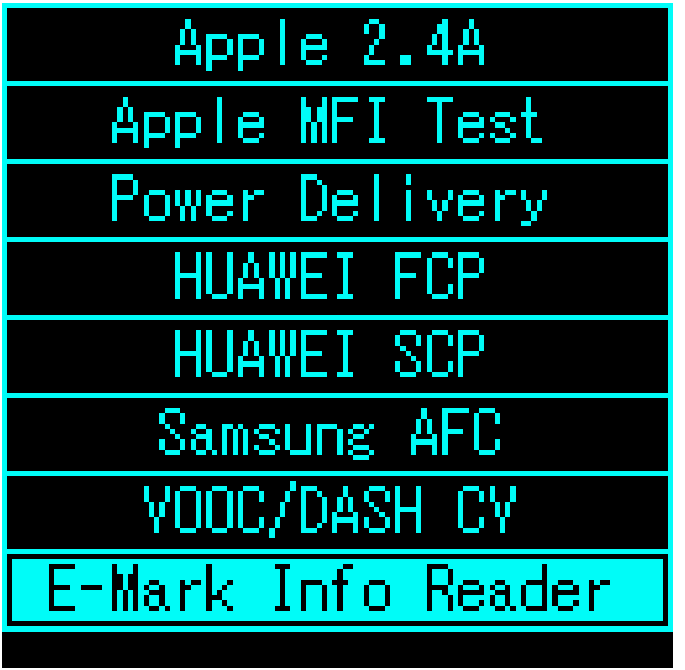


In trigger mode of PDOs of **fixed** type, **scroll the multi-key to left & right** to switch from one PDO to another.



In trigger mode of PDOs of **Augmented PPS** type, **scroll the multi-key to left & right** to adjust the target voltage, and **press the middle key to apply**.

A **double-click on middle key exits** PD trigger mode, with **triggered voltage maintains.**



- **HuaWei FCP**

  The same as QC2.0.

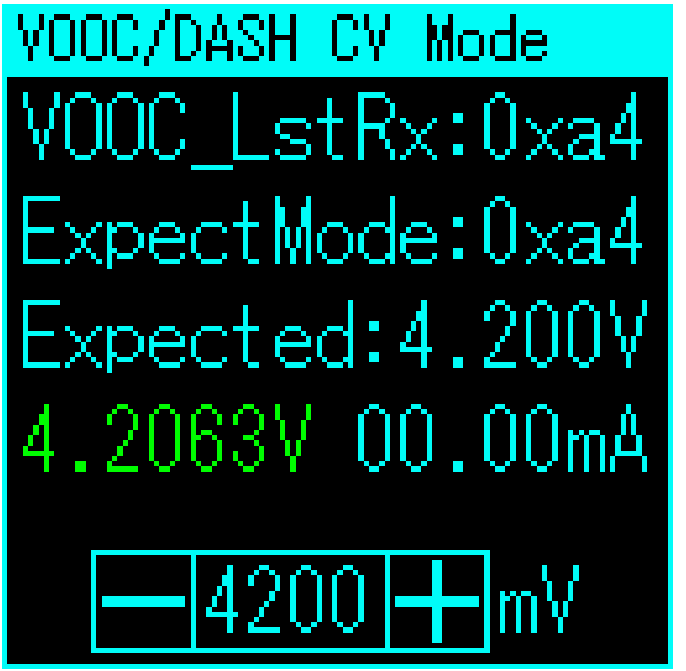
- **HuaWei SCP**

  The same as QC2.0.

- **Samsung AFC**

  The same as QC2.0.

- **VOOC/DASH CV**



The meter support limited trigger feature for adapters with VOOC/DASH protocol (DC0507, AK779 tested), **it doesn't work on third-party cracked adapters and old constant-current mode adapters**. Use **stock cable to** connect the charger to the meter.

For hardware version below V1.02, please apply a load greater than 0.2A, while this is not needed for hardware version V1.02 and above.

After entering this mode, **scroll the multi-key to left & right to adjust the target voltage**, and **press the middle key to apply**.

A **double-click on middle key exits** PD trigger mode, with **triggered voltage maintains.**

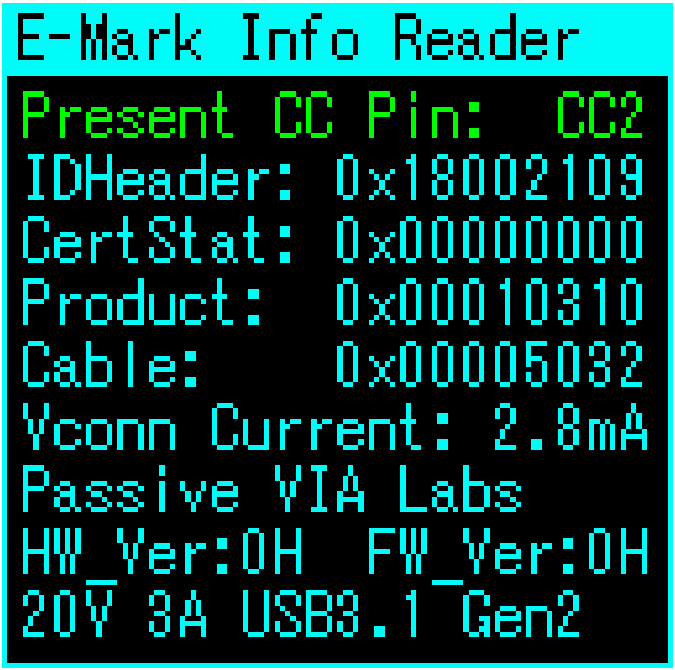
- **FastCharge Release**

After QC2.0/3.0, FCP, SCP, AFC, VOOC/ DASH, PD triggering, **left click the multi-key on main screen** to release the protocol triggered, voltage goes back to 5V as default.

- ## E-mark Info Reader

This feature is only applicable for meters with hardware version V1.02 or above.

Power the meter with power sources which will not occupy ANY type-C ports（An independednt 5V supply is recommended），switch on the PD tester switch, enter this mode, plug-in the cable being read, and the result comes out as following:



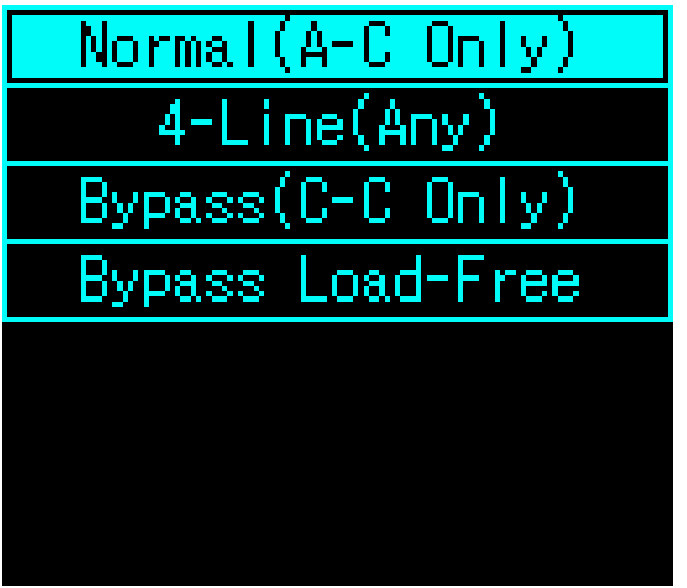
The present communication CC pin, raw data from E-Marker are placed on the top-half of the screen, while brief analysis (Type, vendor, HW_Ver, FW_Ver, Voltage/Current/ Data ratings) displayed on the bottom-half of the screen. Power consumption of the E-mark chip (Vconn Current) is also shown.

Hot-Plug is supported in this mode, you can simply replug a new cable for fast selecting.

Double click the middle key to exit this mode, after that, don't forget to swich off the PD tester switch.

Cable Resistance

The meter can **measure the resistance** of the **USB-A 2 Type-C** cable, and provides a program for 4-line cable resistance test. The meter can also **evaluate** the resistance of the **Type-C 2 Type-C cable**. A load-free mode brings more convinience.



•Normal mode

The procedure of the **normal mode** is :

1. **Connect** the meter to the adapter by the **USB-A male** port. Then plug-in a **constant-current load(>500mA)** into the **USB-A female** port.

2. **Disconnect** the meter.

3. **Reconnect** the meter with an **A-C cable** or a **MicroUSB cable**, then plug-in the **same** load in step1, the cable resistance will be shown on the screen.

•4-Line Mode

The device provides the **software implementation only**, require the usage of the accessory from its provider.

•Bypass Mode

This mode can only **evaluate** the resistance of the Type-C 2 Type-C cable because the meter can **only** get the resistance of the **positive line** inside the cable.

Since the **negative line and positive line usually have the same dimension and material**, the result is reliable in the **most** cases,.

The procedure of the **bypass mode** is :

1. **Connect** the meter to the adapter by the **USB-A male** port. Then plug-in a **constant-current load(>500mA)** into the **USB-A female** port.
2. Plug **both sides** of the **Type-C 2 Type-C cable** into **both Type-C female port** on the meter.
3. The resistance is shown on the screen.

- # Bypass Load-Free

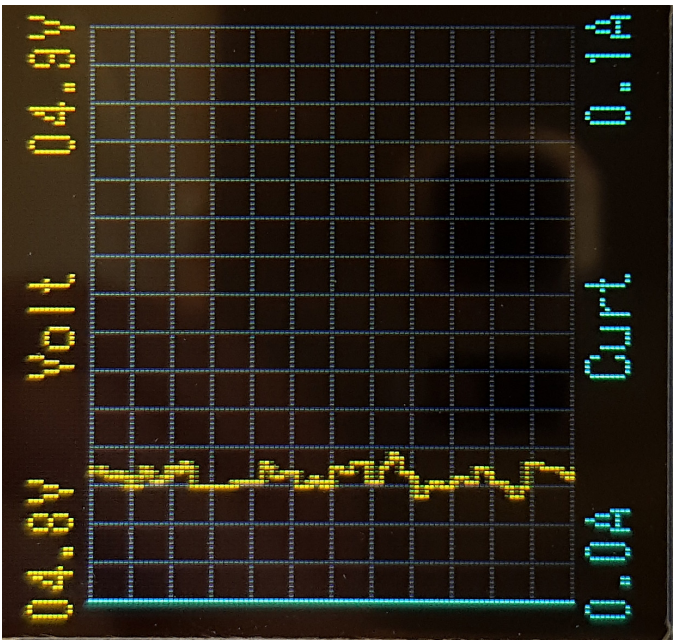
This mode is only applicable with hardware version V1.02 or above.

Instead of an external load, this mode enables the dummy load integrated in the meter. Plug the meter into a common 5V power supply, enter this mode, after the "waiting" window dissapears, plug-in the cable being tested.

Then the resistance comes out, this mode is hot-plug supported.

Diagram Painting

A **double click** on the home screen will make the system into **diagram painting mode**:

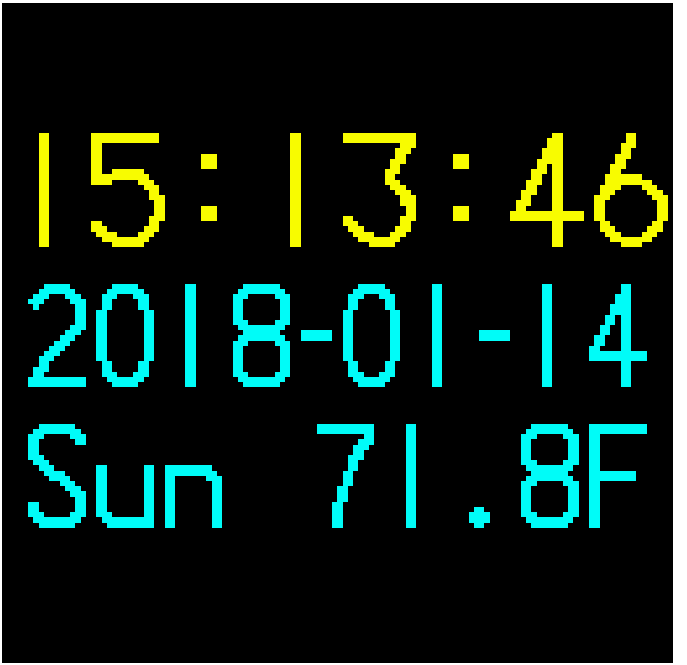


In this mode, **clicks on the middle key** can **toggle** the diagram from **D+D- voltage and voltage-current**. **Double click the middle key** can **exit** this mode back to home screen.

You can adjust the **sample rate** by **scrolling the key to the left & right**, available sample rates are 1fps, 2fps, 4fps, 10fps, 20fps, 30fps, 50fps,100fps.

Idle Clock

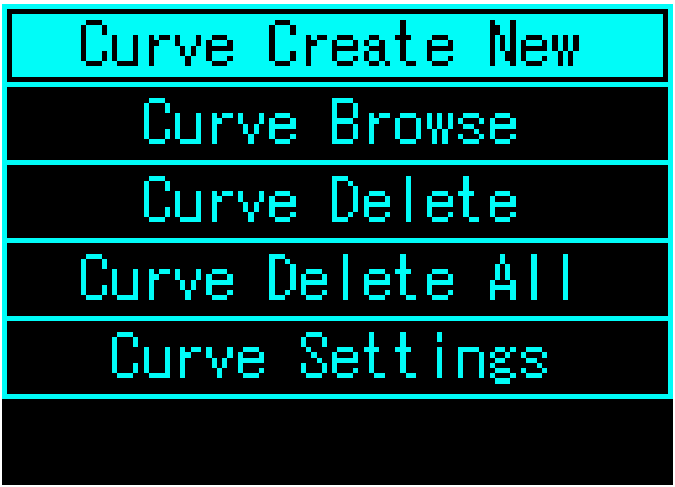
This device can be used as a digital clock when it's not in use. Refer "**Menu**" chapter for the related settings.



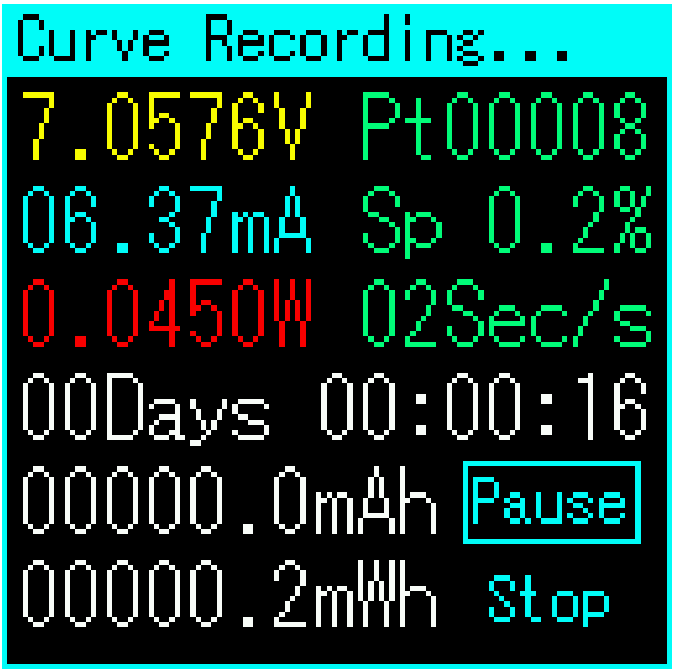
Offline Recording

The device consists "Offline Recording" feature, it can record the voltage & current in a period for further analysis.

Right click at the home page to enter offline recording menu:



- **Curve Create New**

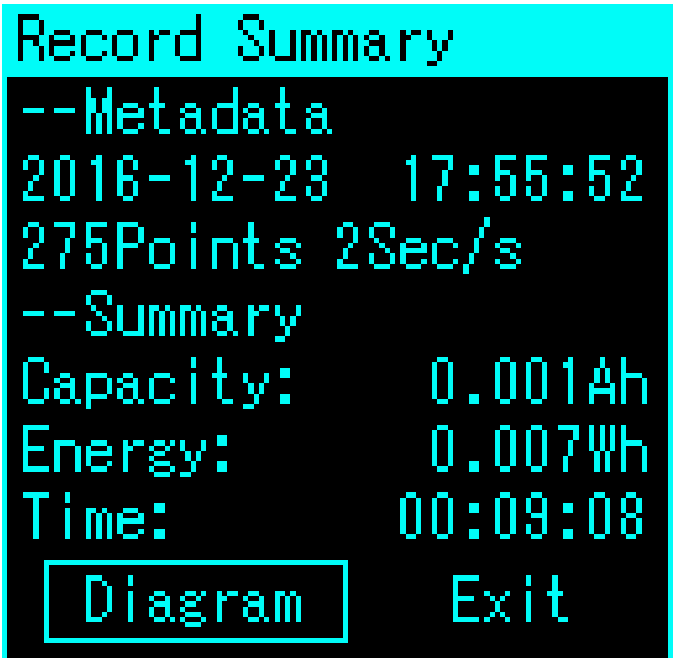


After clicking "Curve Create New" option, the screen will turn to above.

Current voltage, current and power is shown on the top-left side, point No., space condition, sample rate is shown in green, summary data is shown in white.

You can manually pause or continue the record by clicking the "**Pause/GoOn**" button, stop the record by clicking "**Stop**" button.

For **automatic** record starting/stopping, look up in "**Curve Settings**" section.



After a record, the device will enter **record summary** screen.

It shows the starting time of the record, record length, sample rate and summary data including capacity, energy and lasting time.

You can view the record diagram by click "**Diagram**" button, **but it is more recommended to view the chart on PC**.

- **Curve Browse**

  Browse the existing records.

- **Curve Delete**

  Delete the existing records.

- **Curve Delete All**

  Delete all of the existing records.

- **Curve Settings**

The device can store at most **4** curves, each curve can store data of **3750 points. For example, if the sample rate is 2 seconds/ point, each curve can store the data in 3750 * 2 = 7500 seconds, which is about 2 hours.**

You can set a **lower** sample rate to get a **longer** duration, but this will lead the curve to lose some details.

You can evaluate the recording duration, set the sample rate to the maximum possible.

The automatic behavior of the device can be set by "**Start Threshold**" and "**Stop Threshold**".

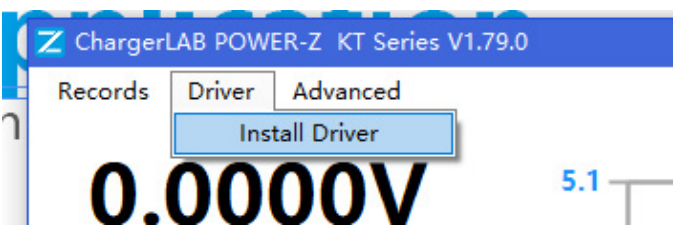
When the current is **lower** than the **start threshold**, the device is in standby mode and won't record any data. Once the current is **above** the start threshold, record **starts**. Setting the start threshold to 0mA means the record always starts after created.

When the current is **lower** than the **stop threshold**, the device automatically **stop** the record. Setting the stop threshold to 0mA means the device never stop the record automatically unless the space is full.

PC Application

The device can be connected to the PC for more features.

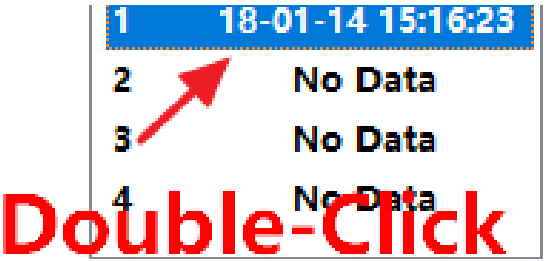
Connect the device to the PC with a **micro USB cable**.



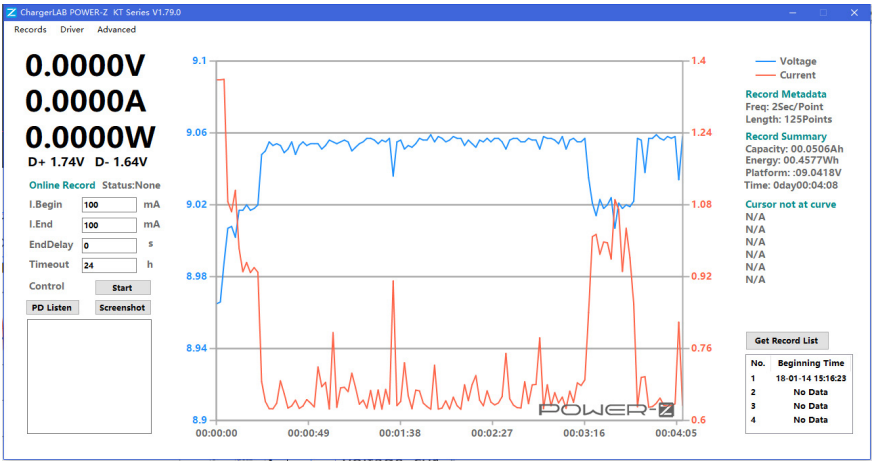
For the first time, you should **install** the driver. Click the "**Install Driver**" menustrip to run the driver installer.

This will be shown if no problem occurred.

- **Offline record readout**

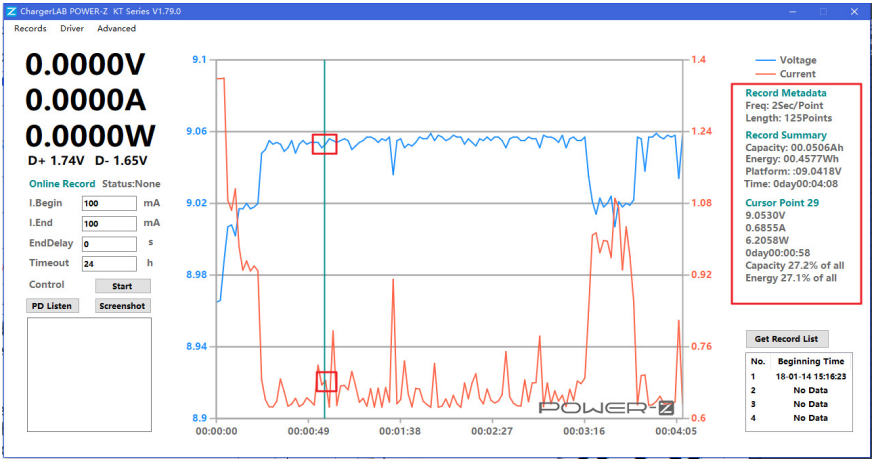


Double click the record which you want to read out. Wait for a second, the diagram will be shown:

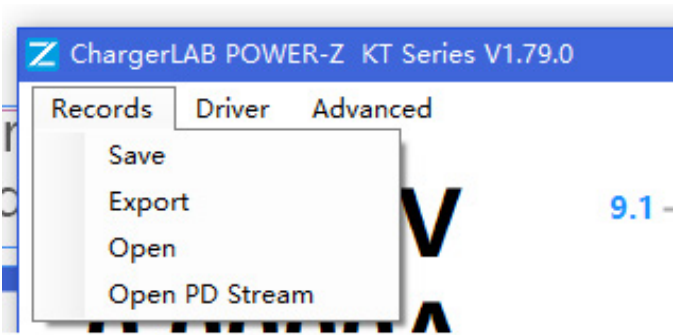


On the right-hand side of the form, the information of the record (sample rate, length, capacity, energy) is shown.

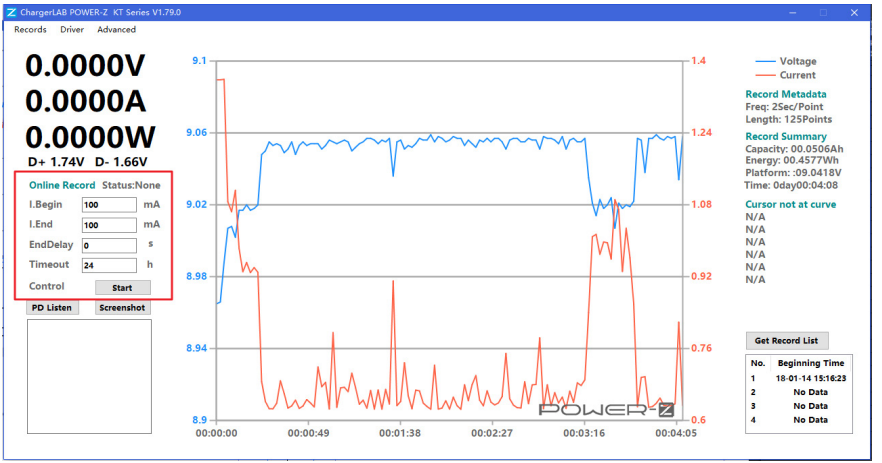
If you want to see the detailed information on a certain point, move the cursor on that point, detailed information at that point will be shown:



Voltage, current, power at that point is shown.



You can save, open or export the record in "Record" menu.



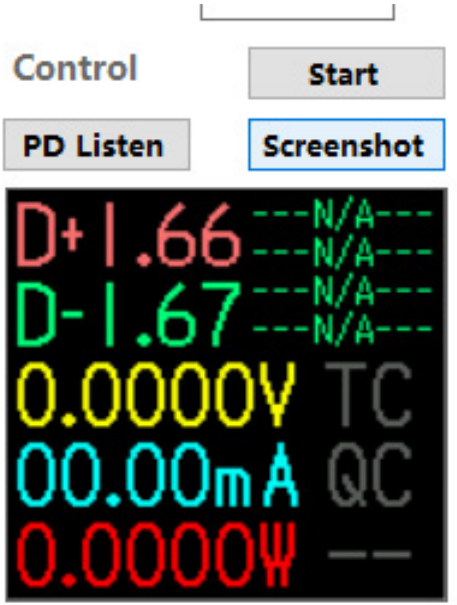
Records can be **directly** recorded by the PC.

Set the **start threshold, stop threshold, stop delay, cutoff timeout**. Then click "**Start**" button to start recording.

when online record is running, the diagram will be refreshed dynamically.

The behavior of online recording is basically the same as offline recording, **the extra option "EndDelay" delays the auto stop behavior to prevent unexpected record stop (When the current is below stop threshold for just a little time).**

Online record can also be saved to file.

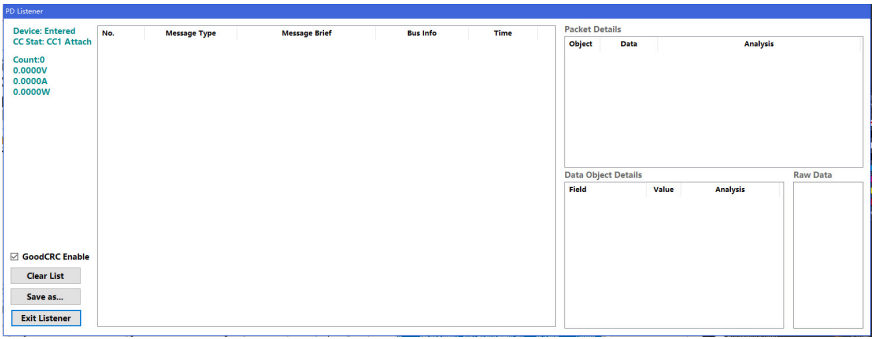


You can get the screenshot of the device by clicking "Screenshot" button.

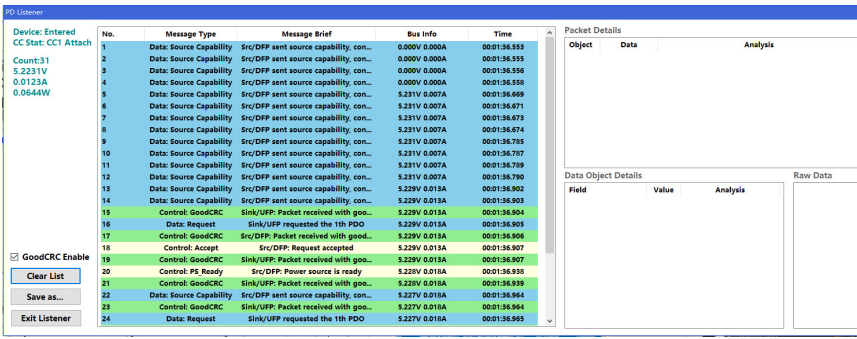
- **PD Listener**

PD listener can **readout & analyze the messages on the CC line.**

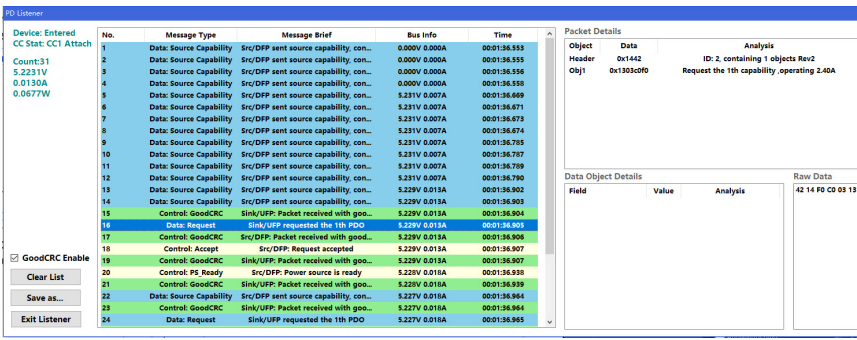
Keep the device on the home screen, click "PD Listen" button to enter PD listener mode.



Make sure the "PD Tester" switch is switched on, connect the device and the PD charger/powerbank, then plug in the consumer(mobile phone etc.), you can see the messages between them on the application:

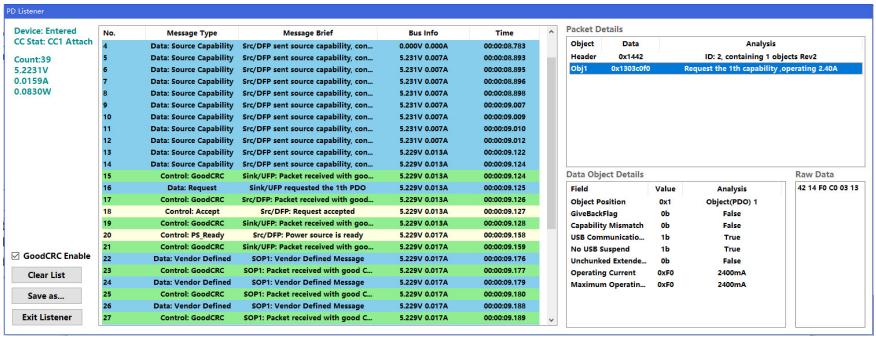


The list on the middle shows the no, message type, message brief, time, voltage & current when the message is sent.



Select the message you concerned, the detailed information (Message header, message objects and their analysis) of the message will be shown on the right, the hex raw data is shown in the box at the right-bottom side (in little-endian).

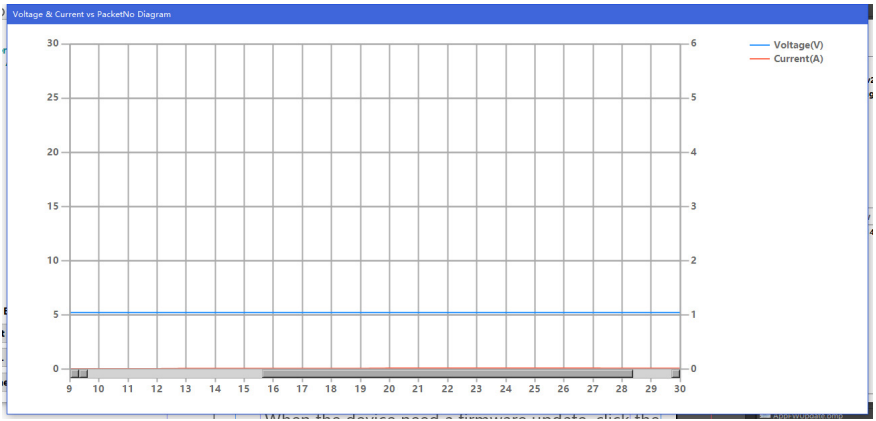
Sometimes, GoodCRC messages will make the messages confusing, you can mask the GoodCRC messages by unchecking "GoodCRC" checkbox.



Select the data object you concerned, the bit fields and their values will be shown below .

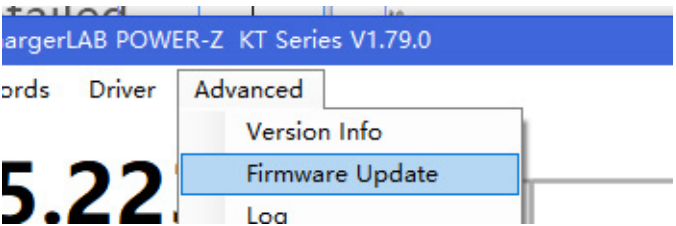
Click "Clear List" to clear the messages.

Click "Save as..." to save the current PD stream for sharing or further analysis, PD streams can be opened at "Records->Open PD Stream".



You can see the voltage & Current when each packet is sent on the diagram form.

- # Firmware Update



When the device need a firmware update, click the "Advanced" menu then click "Firmware Update". A firmware update will be performed automatically.

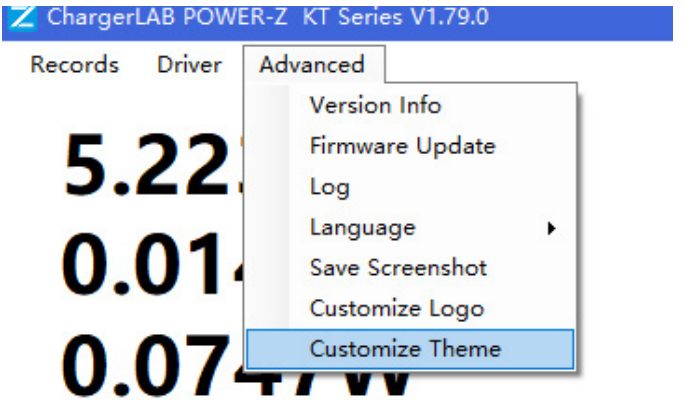
Misc

•Personalized Settings

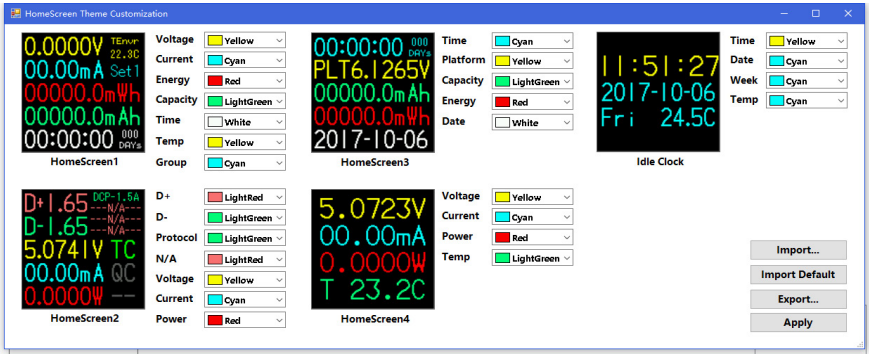
The device has some personalized features.

Enter main menu, select "Personalized", you can change the theme color in "Theme Color" sub-item.

The colors on the main screen can also be customized as following:



Connect the device to PC, click "Advanced->Customize Theme".



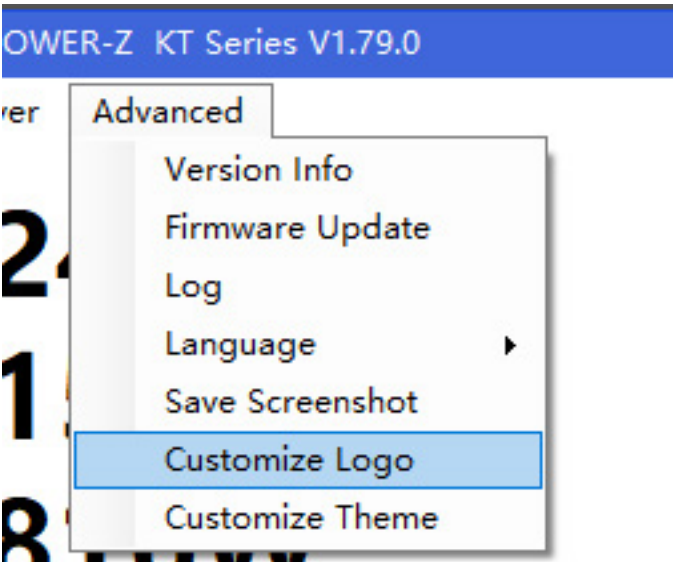
Set colors you expected, the previews update automatically, click "Apply" to apply the theme to the meter.

Click "Export..." to export theme to file.

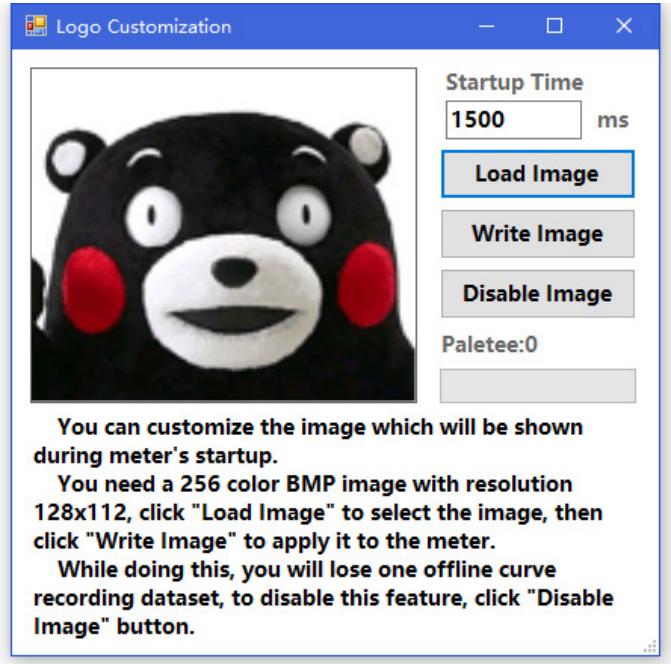
Click "Import..." to import theme from file.

Click "Import Default" to restore to default.

•Logo Customization



Logo which is shown during startup can be customized. Connect the device to PC, click "Advanced->Customize Logo".



Follow the instructions on the window.

•Advanced Settings

Some behaviour of the meter can be changed in "Advanced Settings". Enter "Main Menu->Developer Tools->Advanced Settings"to see them:

Enable/Disable Logo: Enable/Disable logo.

Enable/Disable Warnings: Enable/Disable warnings when you entered fast-charge trigger menu.

•Shortcuts

PD Trigger: You can enter PD trigger quickly by press and hold the middle key during startup.

Auto Trigger: This dangerous feature triggers QC2.0 9V/12V/20V during startup, it can be set at "Main Menu->Developer Tools->Auto Trigger", do not use this feature since it can cause damage to your device easily.