

dicodes E-Cigarette Control Unit “Tiny”: Technical Specification and Manual

1. Common

The *dicodes* Tiny is equipped with a small 2-digit 7-segment display and a single button which can be used to adjust function values as well as fire the device. The top M7x0.5 metric thread is compatible with most vaporizers.

The Tiny has a slightly conical housing—an outer diameter of 19mm at the atomizer-end and 20mm at the base—so it’s very handy and provides an exceptionally good looking design.

The Tiny is engineered for the use of a single “16650” Li-Ion rechargeable battery. (Do not supply the electronic by more than 4.5V.)

Parameter adjustments can be made by clicking the button or holding it for a longer interval. Power is supplied to the coil when the button is pressed for more than 0.25 sec., and continues to be applied until the button is released or the maximum vape time is exceeded.

The selected power—combined with the composition and resistance of the coil—are major factors in your vaping experience. The device is designed to work within a resistance range of 0.7 to 3 Ohms—typically with a 0.16mm Kanthal-wire.

In general, the output power is independent of coil resistance. The power chosen is always transferred to the load (power controller). Vaping is still possible outside the permitted resistance range, vaping but with some power limitations. Optimum efficiency is achieved at about 1.5 Ohm.

The battery holder is powered up by clicking the button 1 to 5 times—which can be set in the Oc (On Clicks) item in the Extended Functions Menu. Further clicks step the user through the programming and error menu. The value of a menu is displayed after a short pause. The value can be adjusted by clicking the button or by pressing and holding the button. The display duration of the menu item and its value can be adjusted in the Extended Functions Menu.

Power is delivered to the coil as soon as the display is off and the button is pressed for longer than 0.25 seconds.

2. Menu Structure

The main menu features the most commonly adjusted functions. (There is also an Extended Functions sub-menu, which enables the user to adjust less commonly used settings.)

- Pu => Power Up increases the output power in steps of 1W or 0.5W. Beyond 15W (or the value set in the extended functions menu item "PL") the power adjustment jumps back to 5W (roll over). Also see half wattage steps option in the Extended Functions Menu.
- Pd => Power Down decreases the output power in steps of 1W or 0.5W. After 5W the power adjustment jumps up to 15W (or the value set in the extended functions menu item "PL", roll over). Also see half wattage steps option in the extended functions menu.
- Co => Check Ohms measure the resistance of the heating coil. The accuracy is about +/-0.05 Ohms. If the button is clicked during the display of the "Co" value, a second value—the AC-resistance—is displayed.
- Cb => Check Battery measures the voltage under load or displays the last voltage measurement, respectively. See 11. Measuring the Battery Voltage.
- Sb => Set Battery defines the minimum battery discharge voltage which is also the threshold for the power reduction slope. See item 7 for further explanation.
- So => Switch Off. When this menu item is displayed and the button is kept pressed, first the decimal points are lit, then the display shows "- -" and then the device turns off. The device can be turned back on by clicking the button the number of times defined in "Oc" in the Extended Functions Menu. See also 13. Further Explanations, item 13.3.
- EF => Extended Functions menu, see item 12 of this datasheet.
- F- => Fault indication. With no fault pending the display shows F-. The error codes are defined as:
 - F1 => Heating coil cover open.
 - F2 => Resistance too high (> 3.0 Ohms)
 - F3 => Resistance too low (< 0.7 Ohms)
 - F4 => Short or loose coil or overload (coil resistance for chosen wattage too high)
 - F5 => Battery (accu) voltage too low
 - F6 => Temperature too high (PCB-temperature > 55°C)
 - F7 => maximum vape time exceeded
 - F8 => Coil resistance too low for power chosen

Note: Depending on the setting of Ec (Error control) in the extended functions menu, certain Errors are either not displayed at all (F2/F3) or no longer need to be acknowledged to reset the fault condition (F1).

3. Power Controller

The electronics within the Tiny govern the output power in a range of from 5W to 15W, or up to 18 Watt (see "PL"). The power control is independent of the coil resistance i.e. it does not matter if the coil has a resistance of 0.7 Ohm or 3 Ohms, the power will always be adjusted to the pre-set value. If the resistance checks (Fault-codes F1 to F3) is enabled in the extended functions menu, the permitted range for the resistance is 0.7 to 3 Ohms.

NOTE: Vaping is possible even when coil resistance is outside the range of 0.7-3 Ohms.

Full power of 18W may not be useable with resistances outside the recommended range (or checked range if enabled). For example, the maximum power of 15W with 0.7 Ohm is reduced to about 10W with a 0.3 Ohm coil. These values were measured on a typical device, but are not guaranteed. In cases where coil resistance is very low and an impermissibly high power has been selected—error message F8 is displayed as an overload indicator. Similarly, with a very high coil resistance and impermissibly high power, fault F4 indicates the overload condition. Vaping is possible only after reduction of power and fault acknowledgement.

4. Time limited power output

The maximum uninterrupted activation time for vaping is limited and depends on the power setting. For a power of up to 10W, maximum vape-time is 20 seconds. Above 10W the time decreases by 1 second per watt, i.e. 12 seconds at 18W.

If the button is accidentally pressed and held, power output is stopped after 20-12 seconds and the display shows F7.

5. Short Circuit Protection

Unintentional shortages between housing and the wire can happen when a coil is installed. If there is a short and the button is pressed—the electronics will not be damaged—the display will show error condition "F4" (short or wobbling contact or overload). After acknowledgement of the error message—and removal of the shortage—vaping is possible again.

Error message F4 is displayed in contrast to error F1 (open coil cover), when a short or opening happens during power output. So F1 is displayed as soon as the coil cover is opened, e.g. when the coil is changed.

6. Reverse Polarity Protection

Several battery manufacturers offer products whose polarity is hard to identify. In the past the coil unintentionally activated or the power switch was damaged because the batter was inserted with reversed polarity. The *dicodes* mod is equipped with a reverse polarity protection so that no current flows in this condition. Vaping is impossible then, of course.

The battery should always be inserted with the +pin first.

7. Deep Discharge Protection and Power Limitation

Common Lithium-Ion batteries have a voltage of about 4.2V when fully charged. During discharge the voltage reduces to between 3.7V and 3.3V and stays within this range while reducing slowly over an extended period of time. At the end of the capacity (about 70-80%) the voltage decreases somewhat faster until its value reaches about 2.5 to 2.7V. If the batteries are discharged below 2.5/2.7V they can be irreversibly damaged or even destroyed due to chemical reactions inside.

Most electronic cigarettes using a lithium-ion battery abruptly disable power output when the voltage under load drops to about 3.3V. This is so inconvenient for the user when no replacement battery is at hand.

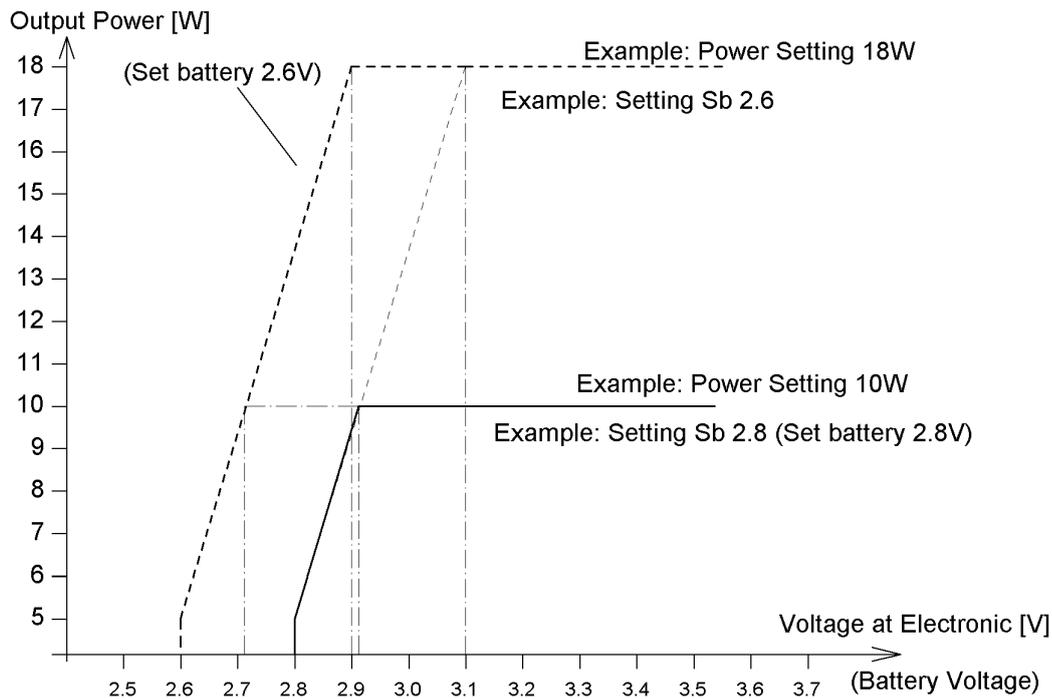
dicodes Tiny does not shut down suddenly. Beginning at a user adjustable voltage, a power reduction is activated, which enables further vaping at reduced power and without changing any other adjustments. The output power reduction is proportional to the decrease in voltage under load of the battery.

The power reduction can be adjusted in menu item "Sb" (Set battery).

The value set under "Sb" adjusts the voltage so the power output is limited to 5W. Vaping is disabled if the voltage drops to the point where this limit cannot be maintained below this value. When voltage drops to this point the error message F5 "battery voltage too low" is displayed. This setting defines the low discharge level of the battery.

The power reduction always starts about 0.3V above the set value referred to 18W (!). The following diagram illustrates how the power reduction works. In general, the lower the power setting chosen, the deeper the battery can be discharged before power reduction starts.

Power Reduction



In the diagram, two example settings of the parameter S_b are shown. With a setting of S_b equal to 2.6V, for example, and a chosen power of 18W, the power reduction starts at a battery voltage (under load) of about 2.9V; this is the dashed line in the diagram. For the second example, S_b is set to 2.8V and the power is 10W. In this case the reduction starts at about 2.92V (bold line in the diagram). With $S_b=2.6V$ and 10W, the power limitation would start at a voltage of about 2.72V (dashed-dotted line).

The reduction in power function appears as flashing decimal points on the display.

8. Temperature Check

The Tiny checks its own temperature (temperature of printed circuit board). Any electronic has so called power losses which increase the temperature in the end. To protect the electronics from overheating, power output is stopped at temperatures above 55°C (approx.). Normally the operating temperature limit is never reached, even with maximum power output selected and normal vaping habit. If the device does overheat error message F6 is displayed. (This can be achieved by permanent vaping with only short interruptions). If an F6 error occurs, the user has to wait until the electronics has cool down and acknowledged the error before vaping is possible again.

9. Auto-Power-Off

When the device is not used for a certain time, the Tiny switches off itself. This time-out can be selected in the extended functions menu to be 1, 5, 10, 20, 30, 60, 90 minutes. This function prevents the battery from draining if the user forgets to turn it off.

NOTE: If “Oc” (On clicks) is set to “0,” vaping is readily possible by holding the button for more than 0.25 seconds. The auto-power-off function can limit unnecessary battery consumption to a minimum, especially when 1 minute is chosen for the time-out.

10. Resistance Measurement

The Tiny is equipped with a resistance measurement. The result is displayed, once the menu item Co (Check ohms) is selected.

Typical coils have a resistance of 0.7 to 3 Ohms, assuming a Kanthal-wire of 0.16mm diameter. The Tiny is optimized for this resistance range. Nevertheless, the user is free to choose a coil of almost any composition and resistance.

Determining the resistance of a coil is typically as follows: Insert the coil, turn on the device click the button twice to get to menu item Co (Check ohms) and wait for the resistance to be displayed.

The following refers to the error control for F1 to F3 being enabled by setting “Ec” in the extended functions menu to 1, only.

If your coil has a resistance outside the recommended range of 0.7-3 Ohms an error message will be displayed. F2 is displayed, if your winding has a resistance greater than 3.0 Ohms. F3 is displayed if your winding has less than 0.7 Ohms. See also item 12 in this menu.

In order to display the resistance, despite the error message, click the button several times until you reach Co again, with the resistance will be displayed after about 0.5 seconds.

If you click the button during the appearance of F2/F3 in the display (it changes to F-) and then go to item Co again you will instantly get the error message again since the resistance is still outside the specified range.

Normally you will open the coil cover and change it. As soon as you open the cover, the error code F1 will be displayed indicating an open coil. Adjust or change the coil and close the cover. Error code F1 is still displayed. Now reset the error by pressing and holding the button. The display should change from F1 to F-. Now you can step through the menu to “Co” to measure the resistance of your coil.

11. Voltage measurement

The battery voltage is measured using menu item Cb. The device measures the voltage in two ways. Either during coil resistance measurement, which represents a light load, or when power is supplied to the coil. The most recently measured value is stored and displayed once you choose Cb.

The Tiny automatically performs a resistance measurement when you turn it on. If you then

choose Cb (Check battery) the voltage at light load is displayed, as this was measured at latest. If you now apply power to the coil by keeping pressing the button for more than 0.25 seconds and then click the button once, that battery voltage during applied power is displayed. Thus you can also check the batteries inner voltage drop, which increases when the battery has reached its end of life. If you like to measure the battery voltage at no-load condition, simply switch off the device, remove the atomizer and switch it on again. As the device tries to check the resistance (no with no heating-wire) you can read the no-load voltage at menu Cb (check battery).

Please note that the no-load voltage of a battery gives you no reliable information about its quality nor it's charging level. A worn-out battery can show 4.1V under no-load, but the voltage will drop dramatically when under-load and then goes right back to 4.1V.

If you believe you have a fully charged battery and it drops dramatically under load, check for dust or dirt in the threads or at the spring and clean them. If you are sure everything is clean but still see a high voltage drop, the battery has reached its end of life.

12. Extended Functions Menu

The Tiny mod includes several additional parameter settings, to meet individual user preferences in the "Extended Functions" menu.

When choosing EF in the main menu, "00" is displayed after a short delay. When the button is pressed now, a blinking pattern is displayed to indicate that the user is now entering the extended functions menu. Clicking the button steps the user between menu items.

Note that the blinking pattern will not disappear until the button is pressed and held. In the following the EF menu-items are explained in detail:

1. Lu => Luminosity of display



Changing the value of Lu will set the brightness of the display in 5 steps. A value of 1 selects the least brightness, 5 selects the highest. The default setting is 4.

2. Pc => Power control



With the number set in the menu item Pc, different modes of a build in power-boost function (short high power output) are selected. See further explanations below.

3. St => Switch off time



The switch off time selects the time in minutes when the device automatically shuts itself off when not in use. The minutes can be selected as 1, 5, 10, 15, 20, 30, 60 or 90. Note that selecting 1 minute together with a setting of Oc=0 the batteries capacity can be fully exploited without any further latency. The default setting is 60 minutes.

4. Oc => On clicks



On clicks defines the number of times the button has to be clicked before the device is switched on after it was switched off). When 0 is selected immediate power output is possible by pressing and holding the button longer than 0.25sec. The Oc range is 0-5 and the default value is 5.

5. Ac => Activation clicks



In contrast to Oc, this menu item selects the number of clicks to enter the menu structure. The number can be selected between 1 and 5 and 1 is the default value.

6. Ct => Click time



When you step through the menu, this value defines the duration of the item display and value display. The range is from 1 (fast), 2 (medium fast) and 3 (slow). Note that the timing within the EF-menu is always set to "very slow", as this menu is used less often (2 sec. menu item, 2 sec. value) and the user is not so familiar with the different entries.

7. Ec => Error control



The user can choose whether to use the wiring resistance range-check feature or not. When disabled (0) the faults F2/F3 (resistance too high/low) are no longer displayed. When the vaporizer is removed, F1 is only displayed when attempting to fire. The fault condition resets after the vaporizer is attached again. The default setting is "range check disabled" (0). When enabled the display instantly shows F2/F3 when the fault condition occurs. The fault has to be acknowledged by pressing the button and holding the button before vaping is possible again.

8. Ho => Half (wattage) steps on/off



With this parameter set to 1, half wattage steps are selected for the Pu/Pd menu. For half watt steps the right decimal point in the display is lit, for example „09.“ designates 9.5Watt.

9. PL => Power Limit set the maximum power



The Tiny is delivered with a default setting of 15W as the maximum output power. If the user wants to increase the maximum setting, the menu PL allows the user to increase the limit up to 18W. See also additional explanations below.

10. Sd => Select defaults



Set defaults helps when the user got lost with any settings.

The default settings are as follows:

Lu	4	Display brightness
St	60	Time-out switch off after 60 minutes
Oc	5	Press button 5 times to switch on device
Ac	1	Menu is entered after 1 click
Ct	3	slowest menu entry
Ec	0	Wiring resistance check disabled
Ho	0	On watt steps selected for Pu/Pd menu
PL	15	Power Limit at 15W

13. Further remarks

1. Extended Functions Menu: Power control (Pc)

The mod Tiny from dicodes is equipped with a new adjustable function designated as Power-Control, which combines 3 functions, depending on the setting.

The 3 functions are:

1. Accelerated heat-up of the heater-wire, i.e. an initial time limited power boost. The power-boost applies 18W to heater. [A quick heat-up is also known from the Dani (PID- control), but without overshoot, and on the Tiny it is implemented differently and is adjustable).
2. A periodic power-boost function: In certain selectable time-periods the maximum power of 18W (on the Tiny) is applied to the heater winding. As a consequence, the temperature of the atomizer is not constant, but varies in a certain range. The temperature range depends on the (average) power setting, the boost setting selected and the type of atomizer and coil used.
Now what is the purpose of this function? => In the liquid – beside the basic substances, whose concentration slightly varies between liquids – there are several flavoring substances. Every single flavor has its own flash point (boiling point) within this composition. This effectively means, that each flavor can only be tasted at a different atomizer temperature. So if the temperature varies only little, the flavor whose flash point is outside the small temperature range does not come to its own. Now by varying the temperature the tasty-flash is much better and more sophisticated.
3. With the activation of the periodic power boost function, the total energy needed for a good taste is reduced. With the periodic boost enabled, it is recommended to lower the average power. This increases the total vape-time, which is advantageous especially when using smaller batteries, like in the Tiny.

The Power-Control can be set in the extended Functions Menu under PC according to the following table:

Setting of Pc	Boost-time (16W) in milliseconds (seconds)	Time of Set Power (according to Pu/Pd) in milliseconds (seconds)	Total average power in Watts referred to 5W
0	--	--	Normal Power, no Boost
1	300 (0,3)	---	Start-Boost
2	450 (0,45)	--	Start-Boost

3	600 (0,6)	--	Start-Boost
4	50 (0,05)	500 (0,5)	6.18
5	80 (0,08)	600 (0,6)	6.53
6	120 (0,12)	700 (0,7)	6.9
7	160 (0,16)	800 (0,8)	7.17
8	200 (0,2)	900 (0,9)	7.36
9	250 (0,25)	1000 (1,0)	7.6
10	300 (0,3)	1000 (1,0)	8.0

So with $P_c=0$ there is no power boost, but the normal settings are used. With $P_c=1-3$ there is an initial 16W power boost, with different length, and with $P_c=4-10$ different time settings of boost and normal power are selectable.

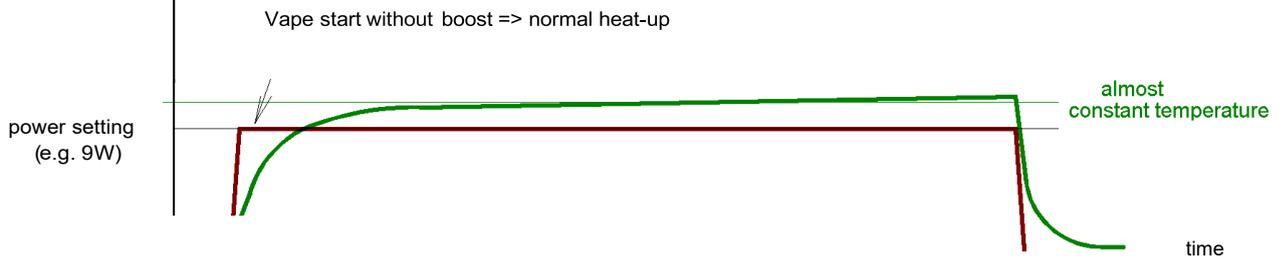
Note: If the max. power under "PL" is set to 16W and the normal power setting is set to 16, the boost has no effect. Also note that if the battery voltage drops to the value set by S_b plus 0.3V, the power limitation starts, indicated by flashing points in the display; this blinking is suppressed during the boost-time, although the power is reduced, i.e. the blinking is only visible for the time of the selected normal power.

The following diagram illustrates the operation of P_c

Power control "off" (Pc) setting "0"

liquid-temperature
power value

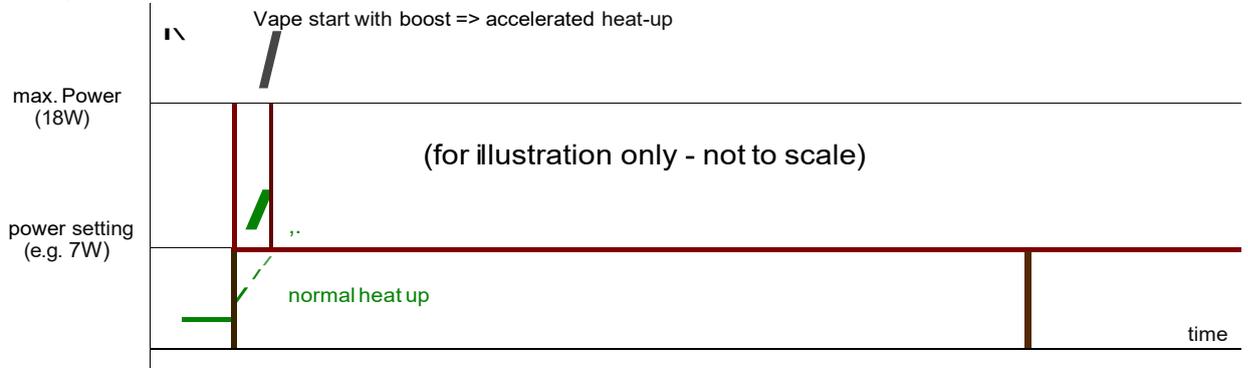
(for illustration only - not to scale)



Power control activated (Pc) setting "1-3"

liquid-temperature
power value

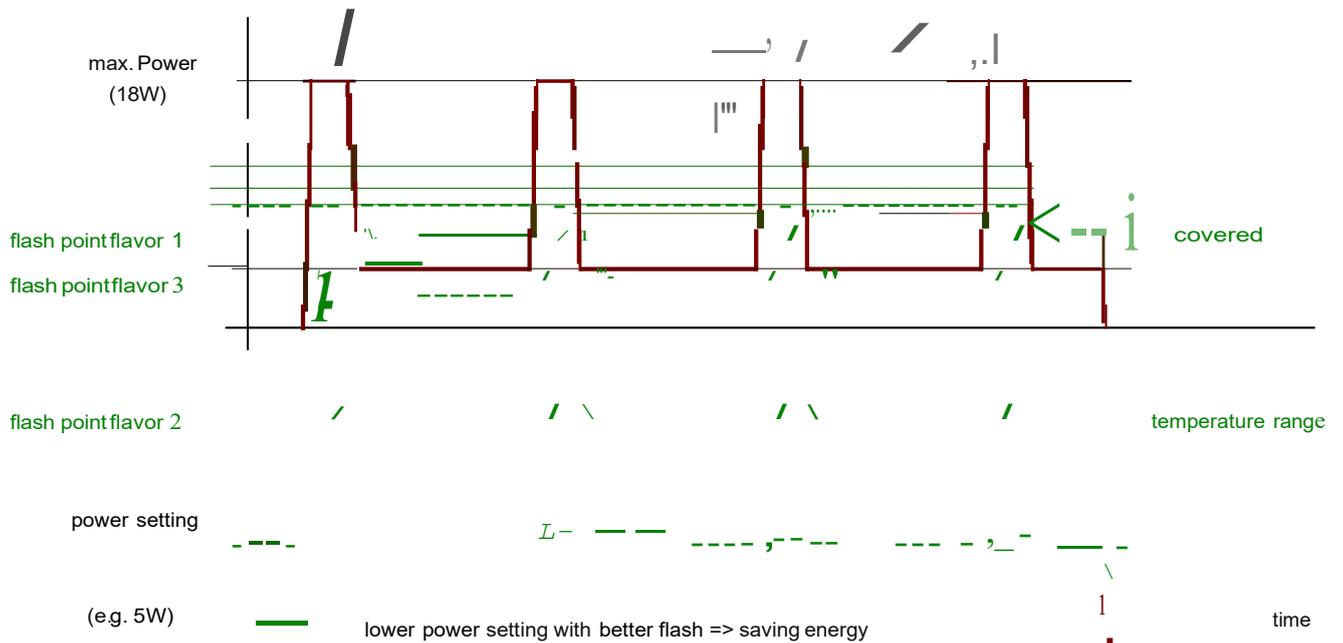
(for illustration only - not to scale)



Power control aktiviert (Pc) setting "4-10"

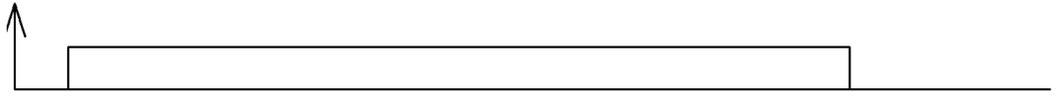
liquid-temperature
power value

Vape start with boost => accelerated heat-up Boost-time to normal power time



Button pressed

(for illustration only - not to scale)



2. Power Limit PL

These very compact atomizers are not designed for power output greater than about 12W. The small size batteries in use are not as powerful as batteries with bigger diameters.

The higher power output on certain atomizers can lead to a burnt taste and even the danger of producing hazardous substances.

Together with the Pc function, the Tiny is able to deliver a remarkably good flash while saving energy when the power setting is reduced accordingly.

Because of this, the Tiny is delivered with a maximum power output of 15W. This power limitation can be changed if the user wants to, e.g. if more powerful batteries become available in the future or if the liquid requires a higher power.

The menu item PL was added to the Extended Functions menu so the user may change the default Power Limit. With the setting of PL the maximum power output can be increased up to 18W in 1 Watt steps. The value of PL changes the range of the Pu/Pd settings in the main menu accordingly.

ATTENTION: The user should always be aware of the fact that when choosing high power, if the atomizer runs dry due to lack of liquid, the heater-temperature may rise significantly, which can create adverse health effects.

Note: The short-term boost function of menu "Pc" does not damage the battery.

3. Behavior during certain values of Oc (On clicks) and Power off

The device can be switched off by entering menu So (Switch off) or left to switch itself off after the time-out minutes.

With the extended function menu OC (On clicks) the number of button actuations can be chosen to switch on the device.

With an Oc value of "0" there is a safety issue. If the button is accidentally pressed and held the device may turn on, power the coil, go into fault condition F7 (maximum vaping time exceeded), exceed the automatic-shut-off limit, power down and then turn back on in an endless loop.

So a safety function has been encoded:

1. If, for a value of Oc less than or equal to 2 **AND** (at the same time) a fault condition **AND** after time-out power off—the device can only be turned on by clicking the button 5 times. This is only required one time under the conditions just mentioned. After this the device works will turn on with the pre-set value of Oc.

2. If, for a value of O_c less or equal to 2 if the device is actively switched off by the user by selecting S_o (Switch off), the device can only be turned on by clicking the button 5 times.

14. Further technical data and specifications

Maximum ratings specify those values beyond which the operation of the device is not guaranteed and could be damaged or even destroyed.

Maximum input supply voltage 4.5 Volts
 Maximum input current 7 Amps

As a protection against malfunctioning which could lead to high input currents and overheating, the mod is equipped with a non-replaceable 7 Amp melting fuse.

Parameter	Minimum	Typical	Maximum	Unit
Output Power (+/-10 %) @ resistance 0.7-3.1 Ohms	5		15 (18)	Watts (rms) at load (1)
Input voltage battery	2.5	3.4	4.2	Volt
Self-current consumption stand-by		22		mA ($V_{in}=3.5V$)
Self-current consumption display active		60		mA ($V_{in}=3.5V$)
Self-current consumption during power output		30		mA ($V_{in}=3.5V$)
Efficiency		95		% (@10 Watt)
Switching frequency		200		kHz
Resistance range, measurable	0.3		9.9	Ohm (2)
Switch off temperature limit (PCB temperature)	52	55	60	°C
Leakage current switched off		1	5	μA
Leakage current reverse polarity			10	μA
Temperature range	-20		40	°C

- (1) Maximum output power within specified voltage range ($S_b + 0.3V$ up to 4.2V) and specified resistance range (0.7 to 3.0 Ohms)
- (2) Measurements in the range of 0.3 to 9.9 Ohms are possible, but outside the range of 0.7 to 3.0 Ohms the results might be less accurate.

- Specifications and Functions are subject to changes without further notice -