

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

### 1. Common

The dicodes Telegonos has a 2-digit 7-segment display and a push-button that enables the user to select functions and adjust values. The top M7x0.5 metric thread is compatible with most vaporizers.

The device has an outer diameter of 17mm and is compatible with a number of slim atomizers—particularly the “Penelope” which also has an outer diameter of 17mm—together they create a nice harmonic look and feel. [Telegonos in Greek mythology was married to Penelope.]

The Telegonos is offered in two different lengths and uses either a “14500” or “14650” Li-Ion battery. (Never supply this device with more than 4.5V.)

This device was designed to be simple, intuitive and safe to operate. Power is applied to the heating coil when the button is pressed for more than 0.25 sec., and power application continues until the button is released or the maximum vapor time is exceeded.

The combination of the power level and the type of coil used determine the user’s vaping experience. The device is designed to work within a resistance range of 0.7 to 3 Ohms and typically uses 0.16mm Kanthal-wire.

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

The battery holder is powered up by clicking the button 1 to 5 times—see “Oc” (On Clicks) in the Extended Functions Menu to select a value. Further clicking of the button steps the user through the programming and error menus. The value of a menu is displayed after a short time. The value can be changed by repeated clicking of the button or by keeping the button pressed (auto repeat). The display duration of the menu can be adjusted in the Extended Functions menu.

As soon as the display is off and the button is pressed for longer than 0.25 seconds the coil is begins heating.

## 2. Menu Structure

The main menu lists the most commonly adjust settings during daily use. There is also a sub-menu, designated as the Extended Functions menu, which enables the user to choose several less frequently adjusted settings.

Pu => Power Up increases the output power in steps of 1W or 0.5W. Beyond 12W (or the Power Limit set in the Extended Functions menu "PL") the power rolls 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. Beyond 5W the power adjustment jumps up to 12W (or the value set in the Extended Functions Menu item "PL"). Also see the half wattage step option in the Extended Functions Menu.

Co => Check Ohms performs a resistance measurement of the heating coil. The accuracy is about +/-0.05Ohms. When the button is pressed during the display of the ohms value a second measurement—the AC-resistance—is displayed.

Cb => Check Battery measures the battery voltage under load, or displays the last voltage measured. See 11. Measuring the Battery Voltage.

Sb => Set Battery defines the minimum battery discharge voltage and therefore also defines the thresholds for the power reduction slope. See item 7 for further explanations.

So => Switch Off. When this menu item is displayed and the button is kept pressed, first the decimal points are lit, then "- -" is displayed, then the device turns itself off. It can be turned on again by clicking the button the number of times defined in "On Clicks" in the Extended Functions Menu.

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 => Resistance of heater winding open

F2 => Resistance too high (> 3.0 Ohms)

F3 => Resistance too low (< 0.7 Ohms)

F4 => Short or loose winding or overload (Heater winding for chosen wattage too high)

F5 => Battery (accu) voltage too low

F6 => Temperature too high (PCB-temperature > 55°C)

F7 => maximum vapor 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 Telegonos limits the output power to a range from 5 Watts to 12 Watts, or up to 16 Watt (see "PL"). The power control is independent from the wiring resistance i.e. it doesn't matter whether 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 check (Fault-codes F1 to F3) is enabled in the Extended Functions Menu, the permitted range for coil resistance is 0.7 to 3 Ohms.

Remark: Even when the wiring resistance is outside the nominal and checked range of 0.7-3 Ohms, vaping is still possible within a limited power range.

For resistances outside the recommended range (or checked range if enabled), full power (16W) cannot always be achieved. For example, the maximum power of about 15W at 0.7 Ohm is reduced to about 10W at 0.3 Ohm. These values were measured on a typical device, but are not guaranteed. If the desired power can not be transferred to the load, fault F4 will appear on the display indicating an overload. After reduction of power and fault acknowledgement, vaporizing is again possible.

### **4. Time limited power output**

The maximum uninterrupted activation time for vaping is limited and depends on the power setting. For up to 10W, the maximum vape-time is 20 seconds. Above 10W the time decreases by 1 second per Watt, i.e. 14 seconds at 16W.

If the button is accidentally activated, power output is stopped after 20-14 seconds and the display shows F7.

### **5. Short Circuit Protection**

When power is applied to the coil, unintentional contact between the housing and the wire can occur and result in a shortage. If this should occur and the button is pressed the electronics will not be damaged. The error code "F4 short or wobbling contact or overload" will appear on the display. After acknowledgement of the error message—and removal of the shortage—vaping is again possible.

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

## 6. Reverse Polarity Protection

Several battery manufacturers offer products whose polarity is hard to identify. In the past it could happen that the heater-winding was powered permanently or the power switch was damaged when a battery was installed incorrectly. The dicodes battery holder is equipped with reverse polarity protection so that no current flows when a battery is installed incorrectly. Vaping is impossible until the battery position is corrected.

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 operates between 3.7V and 3.3V and the voltage stays within this range for a longer period of time. At the end of the capacity (about 70-80%) the voltage decreases somewhat faster until it reaches about 2.5 to 2.7V, below which the battery is irreversibly damaged or even destroyed due to chemical reactions inside.

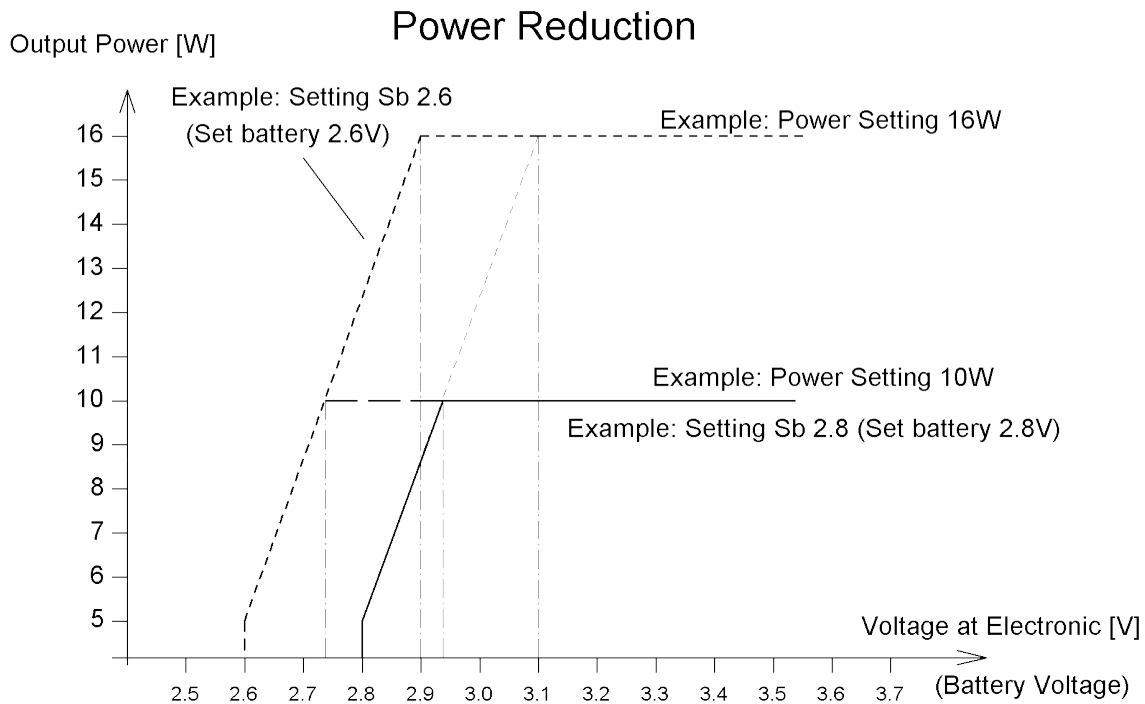
Most electronic cigarettes using a lithium-ion battery disable further power output when the voltage under load drops to about 3.3V. This can be inconvenient for the user especially when no replacement battery is at hand.

In contrast, dicodes devices continue to operate under reduced power beginning at an adjustable voltage. The output power is reduced in proportion to the decrease in battery voltage under load.

The power reduction is adjusted in the "Sb" (Set battery) menu.

The power-reduction output value is 5W. If the voltage drops below this value, vaping is disabled. In this case 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 16W (!). The following diagram illustrates how the power reduction works. In general, the lower the power setting, the deeper the battery can be discharged before the power reduction starts.



In the diagram, two example settings of the parameter Sb are shown. With a setting of Sb to 2.6V, for example, and a chosen power of 16W, 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, Sb is set to 2.8V and the power is 10W. In this case the reduction starts at about 2.93V (bold line in the diagram). With Sb=2.6V and 10W, the power limitation would start at a voltage of about 2.73V (long dashed line).

The reduction in power is displayed by flashing decimal points.

## 8. Temperature Check

The device checks its own temperature (temperature of printed circuit board). To protect the electronics from over-heating, power output is stopped at temperatures above 55°C (approx.). Normally the value is never reached, even under persistent maximum power output.

## 9. Auto-Power-Off

The device can be set to turn itself off if it is not used for a specified length of time. This time-out can be selected in the extended functions menu to be 1, 5, 10, 20, 30, 60, 90 minutes to prevent unnecessary consumption of power. NOTE: If the "Oc" (On Clicks) is set to "0" power output is immediately possible when pressing the button. Thus battery discharge can be limited to a minimum, especially when 1 minute is chosen for the auto-power-off timeframe.

## 10. Resistance Measurement

The Telegonos is equipped with a resistance measurement. The value is displayed when 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 is used. The device is optimized for this resistance range. Nevertheless, the user is free to choose a coil made of a variety of materials which have a range of resistances.

You can determine the resistance of a coil as follows: Once you have installed the coil, turn on the device. Pu for adjusting the power is displayed. Click the button twice to get to menu item Co (Check ohms) — the resistance will be displayed.

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

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

In order to display the resistance measured—despite the error message—click the button until you reach Co, the resistance will be shown after 0.5 seconds.

If you have reset the F2/F3 error in the display (it changes to F-) and go back to item “Co” again, you will get the error message again, because the resistance is still outside the specified range.

When you open the coil cover panel the display will show error code F1— open coil cover. Adjust or replace the coil and press the button. Error code F1 should still displayed. Now reset the error by pressing and holding the button. The display should change from F1 o F-. Check the resistance of your coil in the menu item “Co.”

## 11. Voltage measurement

The battery voltage is measured using menu item Cb. The device measures the voltage in two ways. Either during the 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.

The device automatically performs a resistance measurement when you turn it on. If you then choose Cb (Check battery) the voltage at light load is displayed. If you apply power to the coil by pressing the button longer than 0.25 seconds and then click the button, the battery voltage during applied power is displayed. Thus you can check the batteries inner voltage drop, which becomes greater when the battery nears its end of life.

If you want 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 (with no coil) 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 its charging level. A worn-out battery can show 4.1V with no-load, but the voltage will drop dramatically when loaded. When a fully charged rechargeable battery's voltage drops dramatically under load it has reached its end of life.

## 12. Extended Functions Menu

The Telegonos mod includes several additional parameter settings within the Extend Functions Menu.

Select EF in the main menu, wait for the display to read "00" then click the button, a blinking pattern indicates that the user is now in the Extended Functions menu. Clicking the button steps the user through sub-menu items.

Note that the blinking pattern will not disappear until the button is pressed and held again. The following is a detailed explanation of the EF menu-items:

### 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 lowest brightness, 5 selects the highest. The default setting is 4.

### 2. Pc => Power Control



This setting allows the user to select from several different modes of power-boost (short high power output). See further explanations below.

### 3. St => Switch off Time



The switch off time selects the time in minutes after which the device automatically shuts off. The available selections are 1, 5, 10, 15, 20, 30, 60 or 90. Note that selecting 1 minute together with a setting of Oc=0 allows the user to vape with no delay. The default setting is 60 minutes.

#### 4. Oc => On Clicks



On clicks defines the number of times the button has to be clicked to turn on the device. When "0" is selected power output begins when the button is pressed for 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. 1 is the default value.

#### 6. Ct => Click Time



When you step through the menu, this value defines the duration of the item 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," because this menu is used less frequently (2 sec. menu item, 2 sec. value) so the user is not so familiar with the different items.

#### 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 reattached. 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 and holding the button before vaping is possible.

#### 8. Ho => Half Watt 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 sets the maximum power



The Telegonos is delivered with a default setting of 12W 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 16W. See also additional explanations below.

## 10. Sd => Set 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 short click
Ct	3	slowest menu entry
Ec	0	Wiring resistance check disabled
Ho	0	On watt steps selected for Pu/Pd menu
SA	0	AC resistance check with 200kHz not linearized

## 13. Further remarks

### 1. Extended Functions Menu: Power control (Pc)

The mod Telegonos from dicodes is the first to be 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 16W to heater. [A quick heat-up is also known from the Dani (PID-control), but without overshoot, and on the Telegonos it is implemented differently and is adjustable).
2. A periodic power-boost function: In certain selectable time-periods the maximum power of 16W (on the Telegonos) 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 in use.

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's recommended that the user lower the average power. A lower power expands the total vape-time when using smaller batteries— like in the Telegonos.

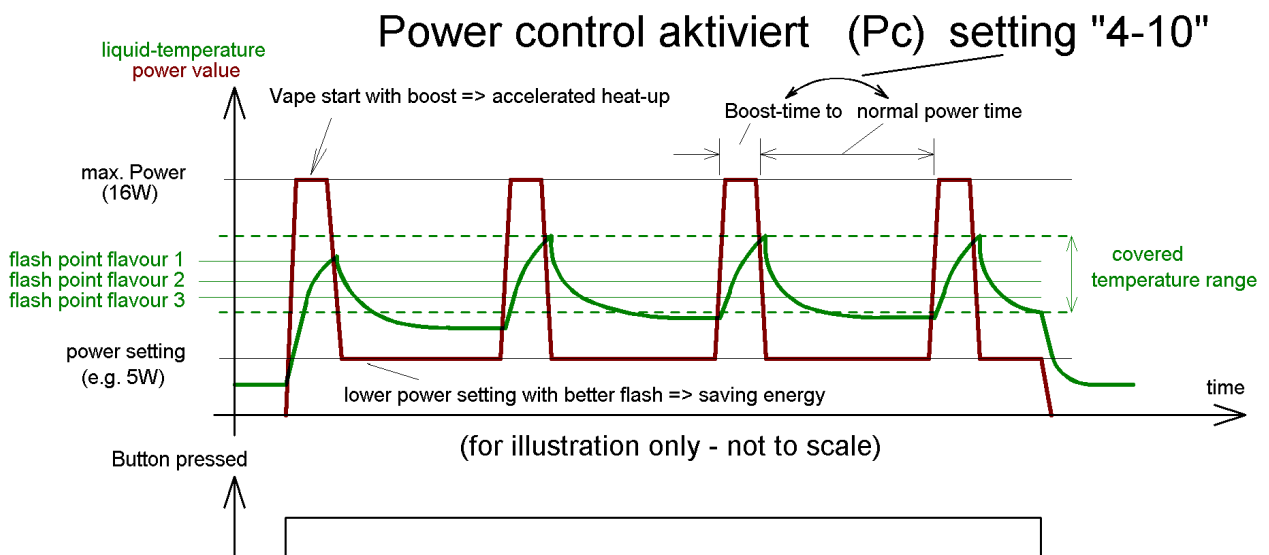
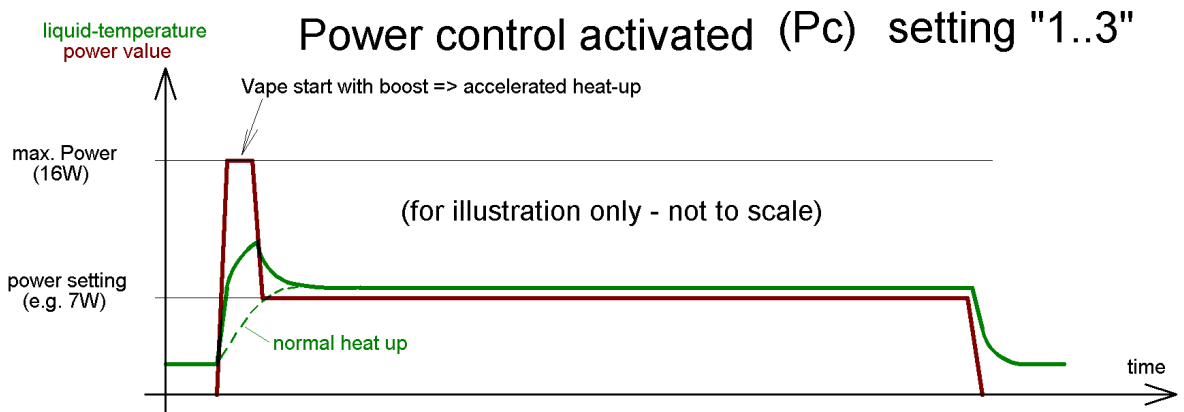
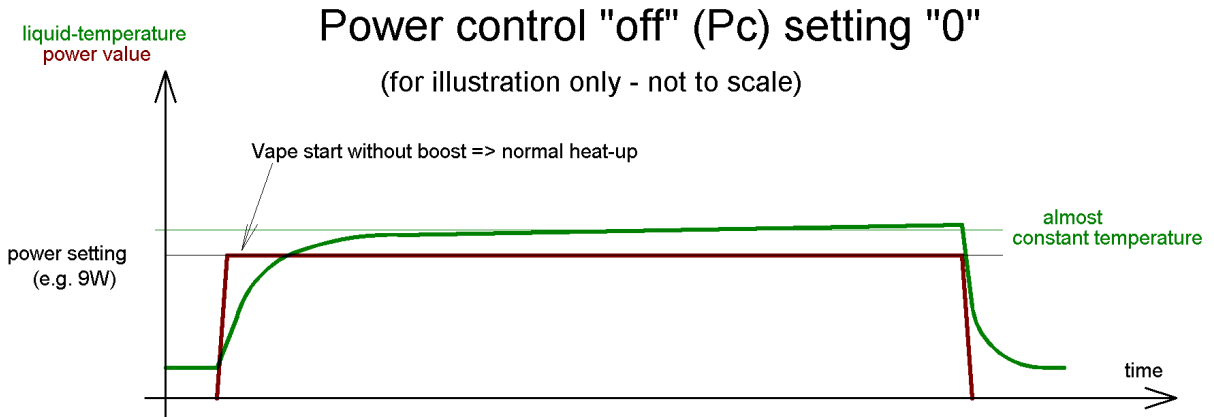
The Power-Control can be set in the extended Functions Menu under PC according to the following table:

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 Pc=0 there is no power boost, but the normal settings are used. With Pc=1-3 there is an initial 16W power boost, with different length, and with Pc=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 16W, the boost has no effect. Also note that if the battery voltage drops to the value set by Sb 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 duration of the normal power phase.

The following diagram illustrates the operation of Pc



## **2. Power Limit PL**

The Telegonos is a compact atomizers and is not designed for power output higher than about 10W. The Telegonos is designed for the use of 14500 or 14650 Li-Ion batteries. These small size batteries are not as powerful compared to batteries with bigger diameters.

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

The Telegonos delivers a maximum power output of 12W. This power limitation can be adjusted to meet user preferences, 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 to allow users to change the default power limit. The maximum power output can be increased up to 16W in 1 Watt steps. The value of PL changes the range of the Pu/Pd settings in the main menu accordingly. Please consider that the currently available Li-Ion batteries with 14mm diameter should not be permanently discharged with current greater than 2V, i.e. about 2 Amps. With a fully charged battery this gives about 8W of continuous power output. The continuous discharge limit is based on the self-heating of the battery and not because of the dicode device.

Note: The short-term boost function of menu "Pc" will not harm 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 switched 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.

There is a safety issue with an Oc value of "0." If the button is accidentally pressed and held the device switches on, the coil heats, the device goes into fault condition F7 (maximum vaping time exceeded), reaches the (short) time-out limit, turns off and instantly powers on again in an endless loop.

A safety function has been implemented:

1. If, for a value of Oc less than or equal to 2 AND a fault condition AND after time-out power off— the device can only be turned on by clicking the button 5 times. This action is only required one time for this particular issue. The device will return to turning on according to the number of clicks set in the "Oc" item.
2. For an Oc value of less than or equal to 2 when the device is manually turned of by the user by selecting So (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 damage or even destruction can not be excluded.

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 self heating, the battery holder is equipped with non-replaceable 7Amps melting fuse.

Parameter	Minimum	Typical	Maximum	Unit
Output Power (+/-10 %) @ resistance 0.7-3.1 Ohms	5		16	Watts (rms) at load (1)
Input voltage battery	2.5	3.4	4.2	Volt
Self-current consumption stand-by		22		mA (Vin=3.5V)
Self-current consumption display active		60		mA (Vin=3.5V)
Self-current consumption during power output		30		mA (Vin=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 (Sb + 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 -**